Plates. { Drawings of Cope & Stewardson.
Measured Drawing Fonte, Piscaja, Siena.

LIBRARY OF CONGRESS COPYRIGHT JUN 1 1896 CITY OF WASHINGTON

THE BRICKBVILDER

DEVOTED TO THE INTERESTS OF

ARCHITECTVRE IN MATERIALS OF CLAY

PUBLISHED MONTHLY.

85 WATER STREET, BOSTON, MASS.

VOLVME FIVE

MAY MDCCCXCVI

NVMBER FIVE

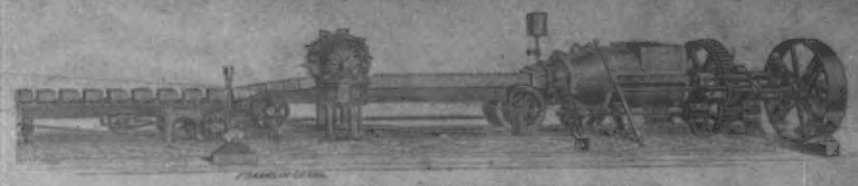
CONTENTS

		PAGE.
EDITORIALS		75
COMPETITION — PROGRAM		76
ARCHITECTS' USE OF COLOR	*Quoted*	77
THE RESISTANCE OF BRICKWORK	*C. M. Blackall*	78
A Résumé of Tests recently made under the direction of the R. I. B. A.		
FIRE-PROOFING DEPARTMENT		
Fire-proof Floor Arches (continued)	*George Hill*	81
MORTARS AND CONCRETE DEPARTMENT		
American Cements (continued)	*Uriah Cummings*	84
What Can Be Done with a Barrel of Portland Cement		85
Meaning of "Hydraulic" as Applied to Mortars and Concrete		85
MASONS' DEPARTMENT		
The Architect and Contractor (continued)	*Thomas A. Fox*	86
Mantels	*A. Mayer*	86
RECENT BRICK AND TERRA-COTTA WORK IN AMERICAN CITIES AND		
MANUFACTURERS' DEPARTMENT		88

For Index to Advertisements see page xxvii.

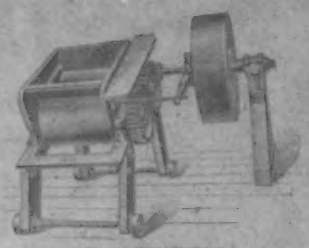
THE DARTA PRESS, BOSTON.

CLAY WORKING MACHINERY.



No. 1. GIANT MACHINE WITH AUTOMATIC TABLE.

DRY AND WET PANS.



CLAY CRUSHERS.

DUMP CARS.

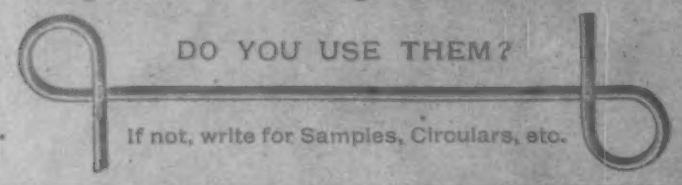
THE FREY, SHECKLER CO., Bucyrus, Ohio.

Send for Catalogue.

TIFFANY
PRESSED BRICK CO.,
MANUFACTURERS OF
Pressed and Enameled Brick,
PLAIN AND ORNAMENTAL.
1149-50-51 New Marquette Bldg.
CHICAGO.

Progressive Architects
Use the....
Morse Patent Wall Tie
For bonding Hollow Walls, Brick Facings, etc.. It is Strong and Reliable.

J. B. PRESCOTT & SON,
Sole Manufacturers,
N. Y. Office: 62 Reade Street.
Webster, Mass.



Cream White Brick

Made by
The Brooke Terra-Cotta Co.
Lazearville, West Virginia,

Are smooth, dense, hard, and better than any so-called "white brick" on the market. They do not change color.

We can furnish

High-Grade Pressed Front Brick,

from the lightest shade of CREAM to the darkest shade of BUFF.

We were forced to turn away orders last season, but have largely increased our capacity and hope to take care of all business offered us this season.

We make the Lightest Shade Cream Brick on the market.

Brooke Terra-Cotta Co.

ROOF SHOWING NEW MODEL GUARDS.

FOLSOM PATENT ROOF SNOW GUARDS,

FOR OLD AND NEW ROOFS, SLATE, SHINGLE AND TILE.

The Folsom Method is Scientific and is displacing the Guard Rail.

Correspondence Solicited.

FOLSOM SNOW GUARD CO.,
178 Devonshire St., Boston, Mass.

The LaSalle Pressed Brick Co.,

LaSALLE, ILL.

MANUFACTURERS OF

Red, Buff, Pink

FRONT AND ORNAMENTAL BRICK

Write for Catalogue.

FOR INFORMATION ABOUT
U. S. MAIL CHUTES,
Which are a necessity in Office Buildings and Hotels, write to the sole makers
THE CUTLER M'F'G CO., ROCHESTER, N. Y.
PATENTED. AUTHORIZED.

D. J. CURTIS,
Springfield, Mass.
Circular Brick
for Power Chimneys.
Ornamental Brick Molded in Sand and Re-pressed.

DAY BRICK CO.,
Manufacturers of
Fine Pressed Red Brick.
SAMPLES ON APPLICATION.
WORKS AND OFFICE, BELLEVILLE, ILL.

GOETZ

BOX ANCHOR AND WALL PLATE prevents dry rot and is self-releasing.
JOIST HANGER is forged of wrought iron and takes place of Mortise and Tenon.
POST CAP is the best and easiest to put up and costs the least.

THE GOETZ JOIST HANGER

In 14 sizes is carried in stock ready for instant shipment.

Box Anchors and Post Caps are supplied by licensed foundries who pay us royalty. Joist Hangers are sold through the Hardware Trade.

Goetz Box Anchor Co.,
70 State St., New Albany, Ind.
Illustrated Book for catalogue.

DO YOU WANT CREDIT REPORTS ON MEN WHO MAKE BRICK? ON MEN WHO BUY BRICK? ON MEN WHO SELL BRICK?
Trustworthy service at lowest prices; ordinarily $1.00 for each report.

DO YOU WANT RELIABLE LISTS OF BRICK MANUFACTURERS AND SUPPLY MEN IN ANY STATE, IN ANY COUNTRY?
These can be furnished at small cost, usually $1.00 for any single list.

DO YOU WANT ADVANCE REPORTS That ARE advance reports of all contemplated construction work calling for BRICK?

DO YOU WANT TO KNOW—How to sell BRICK to the Government? Where there is a good opening for a BRICKYARD? Who are the new BRICK firms and companies? What are the latest BRICK-making inventions? and a dozen other things that every BRICKman ought to know, and the knowing of which means more business and better business? Address with your latest catalogue or circular.

Commercial Intelligence Dep't. ASSOCIATED TRADE & INDUSTRIAL PRESS,
Rooms 9, 10, 11, 12, and 13, 610 13th Street, Washington, D. C.
ESTABLISHED NINE YEARS.

VOLVME V MAY 1896 No. 5

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada . . . . . $2.50 per year
Single numbers . . . . . 25 cents
To countries in the Postal Union . . . . . $3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

THE recently published Report of the United States Commissioner of Labor contains a very exhaustive study of the problem of the housing of the poor, the investigations including practically all that has been done in this country and abroad. In looking over the report, it is interesting to notice the extent to which glazed brick is used in modern tenement-house construction. In the White buildings, Brooklyn, and in the structures erected by the Guinness trust in London, two of the most conspicuously successful groups of modern tenement-house construction, all of the corridors are lined, at least in the lower portions, with enameled brick, and in some cases the enameled brickwork is carried to the ceiling. Some day, it is to be hoped, a truly model tenement house will be erected, suitable for the wants, limitations, and evil propensities of the lowest and most unruly tenants. Glazed brick would form a very important feature of any such structure. Any one who has had occasion to study the tenement-house problem knows that the cheaper class of tenants will destroy everything that is not of the most durable, imperishable character. Plaster is not hard enough for the walls. They must be of some material that will not hold the dirt, and upon which a hose can be turned periodically to wash out the accumulated filth. The floors must be made of something that will not burn in the kitchen stove, and all finish must be of either iron, brick, or stone. We are so accustomed to plaster walls in this country that it is hard to imagine, off-hand, a comfortable, homelike apartment, the walls of which are finished in enameled brick or tile; but it is perfectly possible to so select the colors and shapes that a warm, pleasing effect is possible; and the glazed material would be so much more permanent and, in the long run, so much more satisfactory than a perishable material like plaster or wall paper, that, though the first cost would be relatively high, brick or terra-cotta would prove most economical.

BLACKMAIL ADVERTISEMENTS.

WE have received a letter from one of our largest manufacturers of architectural supplies, calling attention to what is quite properly styled "an epidemic of advertising schemes," from which many of the dealers in high-class building material have suffered. Our correspondent states that "hardly a day passes but that we are importuned to advertise in some souvenir, architect's portfolio, book of sketches, etc. To put it mildly, the thing is rapidly becoming annoying. These demands come to us from all over the country. In a late conversation with a leading architect, he considered the scheme was a direct insult to the profession, and that no architect of any standing should countenance it. Unfortunately, these schemes are handled by some scheming publisher, who secures a list of material men from the architect, and then proceeds to work them, at the same time insinuating with velvet touch, in case the one approached does not take kindly to his suggestion, that Mr. So-and-So would hardly feel inclined to specify his goods in the future, and here, we regret to say, the architect in most cases becomes a party to the transaction. This, it seems to us, is simply blackmail."

In our judgment, our correspondent uses exactly the right names. It is blackmail. And it is more vicious in its tendency for being generally unintentional. Dealers are, we believe, always inclined to give credit to an architect's good intentions; and we doubt whether architects fully appreciate how demoralizing of good intent it is for them to lend their names to mere advertising schemes, which are used in improper manner by unscrupulous agents. An architect cannot be too careful of his professional reputation, and he simply sacrifices his own influence for no return by permitting his name to be used as a lever in soliciting advertisements. We regret to say that this practise has gone to an extreme which calls for serious consideration, and it is not confined simply to a few of the minor architects, whose influence, after all, would be limited to a small circle.

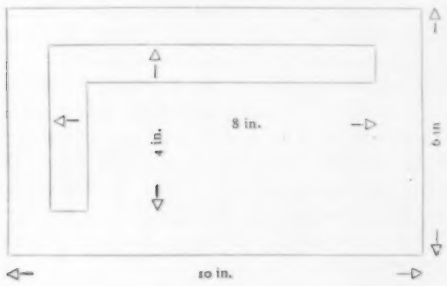
Our best architects and most honored architectural societies look at this matter in a light which shows that they do not propose to be made vehicles of commercial gain by unscrupulous publishers, and we hope that the feeling may become general, both for the dignity of the profession and for the sake of the relationship, which should exist between architects and supply people.

While on this subject, there is another side which we wish to mention. We believe honor should be given to whom honor is due. Advertising is the backbone of nearly all our modern publications, and should be encouraged in every legitimate manner; but there is no good reason why architects should daily be made to suffer by the public press from a mistaken feeling on the part of the reporters and editors of our papers regarding the effect of the publicity of an architect's or a builder's name in connection with one of his buildings. We have known repeated instances where reporters have been to the architect or the builder of a prominent build-

ing, and have plainly said in so many words, that in case Messrs. So-and-So refused to pay a certain sum of money, the reporter and the editor of the said paper would make it their business to see that Messrs. So-and-So's name was not mentioned directly or indirectly in connection with the building which had just been completed. This is decidedly blackmail of the meanest and most contemptible sort. If the publication of the architect's or the builder's name is not legitimate news, it ought not to appear at all; but if it is news which is of interest to even a small portion of the readers of the paper, the name ought to appear, and in common justice to the builders and the architects, who so often are forced to assume large responsibilities with but slight remuneration and scanty thanks, it is only right that they should receive the acknowledgment of the good they have done, or the public avowal of responsibility placed where it belongs; and for a self-respecting journal to refuse to publish the names of the architects or builders, shows a woeful misconception of the feeling which we believe is most prominent on the part of the creators of our public buildings. It is not a matter of advertisement so much as of news and justice, and if the newspaper can find an excuse for publishing the names of every obscure committee man who figures in the most minute social function, or the floor walkers in every third-rate dance, there surely is no just excuse for omitting the names of the architects and builders.

The Barta Press Competition.

PROGRAM.



WE are authorized by The Barta Press, Boston, to announce a competition for designs for ornamental borders to be used in connection with display printing. These borders should be designed so that they can be adapted to various sizes of pages, and should also be of a nature which will permit of portions being used separately as head or tail pieces at the beginning or ending of paragraphs or pages; consequently, the patterns, while complete in themselves, should be such that will repeat and reverse. The average width of the pattern should not exceed ½ in., and the design should be of a sufficiently bold character to permit of photographic reproduction. The drawings must be made in line with black ink on sheets cut to a uniform size of 6 ins. by 10 ins., and the design should include a corner and 8 ins. of the pattern across the top and 4 ins. of the side, as indicated by the diagram, so as to give a complete idea of the design. For the best designs there is offered a first prize of $50; a second prize of $25; a third prize of $15; a fourth prize of $10; and a fifth prize of $5. The prizes will be awarded by a jury of three architects of acknowledged reputation. Each drawing must be marked with a motto or cipher, and a sealed envelope similarly marked and containing the full name of the designer must accompany the drawings. These envelopes will not be opened until after the award is made. After the judges have made their awards, The Barta Press shall have the privilege of selecting for their exclusive use fifteen or more of the designs that are not prize winners, for which will be given the choice of one volume of Bates, Kimball & Guild's "Details of Decorative Sculpture, French Renaissance," or "Details of Decorative Sculpture, Italian Renaissance." Drawings must be delivered flat, express or postage prepaid, at the office of THE BRICKBUILDER, not later than July 1.

The high character of the work which is turned out by The Barta Press has been so abundantly manifested in the pages of this journal as to need little additional comment. The competitors may feel assured that their designs, if used at all, will be most scrupulously followed and all of the prize designs will be published in THE BRICKBUILDER.

REGARDING the Barta Press Competition, it should be stated that contestants have the privilege of submitting more than one design. Each design, however, should be upon a separate sheet. All designs submitted will be judged separately, and prizes awarded accordingly.

ILLUSTRATED ADVERTISEMENTS.

AN illustration of the Second National Bank, Paterson, N. J., will be found on page xxvi, and the adjoining print is from a pilaster capital, used on the same building. The basement, up to water-table, is granite, the two first stories marble, and all above that is terra-cotta and brick, both being supplied by the New York Architectural Terra-Cotta Company.

It is worthy of note that no sheet metal is used on the roof, except as flashing, and for gutters, etc. The highly ornamental hips to the mansard pavilions terminate in grotesque masks, and they in turn form part of an ornamental parapet, all of which are executed in

solid blocks of terra-cotta, and are supported directly on the constructional ironwork of the roof. The same is true of the elaborate festoon ridge cresting and of the ornate chimney stacks, which together serve to heighten an already effective sky line.

Mr. Charles Edwards, of Paterson, is the architect of this, as he is of nearly all the best modern business premises in that thriving city. Notably among these may be mentioned another successful bank building, where terra-cotta is also largely used, the Paterson Savings Institution, and in which his own offices are situated.

PERSONAL.

N. S. SPENCER, formerly practising architecture in Beatrice, Neb., and Stanford Hall, formerly practising architecture in Urbana, Ill., have formed a copartnership, with headquarters in the Rugg Building, Church Street, Champaign, Ill.

S. MILTON EICHBERG, architect, formerly Lamson & Eichberg, Teutonic Building, Chicago, has removed to Suite 323, Continental National Bank Building, 218 La Salle St., Chicago.

NEW BOOKS.

FROM *Prologomenos on the Function of Masonry in Modern Architectural Structures, by R. Guastavino, Architect, 9 East 59th Street, New York.* "There are very few buildings in which the workmen apply the principles that science calls for, nor do they know the necessary rudimentary practises. For instance, a few days ago the contractor of a very important building of a public character now being erected in a large northern city of New York State said to one of the trustees: 'If the terra-cotta and the iron are delayed much longer and we are obliged to work in winter, we shall be forced to mix some lime in the cement mortar, to permit us to lay brick in cold weather.'

"It is almost impossible to conceive that responsible people will thus recommend and accept such a remedy, which is of no more value than a child's mud pies. But it is a fact that most architects in this country, where we have freezing weather from three to four months of the year, look upon such a practise with indifference and only a few of them see the absurdity of it." . . .

"At the present epoch we are so accustomed to see everything treated with nineteenth century manipulation, perhaps only to benefit intermediate trades, that very few people realize the fact that the common and most abundant materials for masonry construction are the most convenient, cheapest, and proper in the end for building purposes. The trouble is that we take too much pains in looking for expensive materials under the impression that they are the best.

"Thus we come to American architecture, which, after passing four centuries since the end of the Middle Ages, and no matter how it arose, in an anomalous way, is extending rapidly into a noble system of general construction, calling into use the three modern materials of building — Portland cement, burnt clay, and iron. These materials have been combined in such new structural conceptions that each is complementary to the others, realizing the ideals of their epoch in accordance with modern science and experience to such an extent that the architects of the time of Phidias could, we believe, endeavor to harmonize with success with the philosophy of their epoch, although yet we are far from reaching perfection, due more to the conventional engineering, iron interests, fear and lack of convictions, which will disappear in time through experience.

"We are thus in a similar position as the Romans were in the time of Augustus. We have changed the form and manner of construction from those of the Greeks, just as the Romans did, but kept the forms of the Greek as decorative suggestions, and besides, the Roman monumental forms, constructed not in a classic spirit, but in an undignified mercantile iron false construction, which is, by the way, just what the esthetics criticize the most severely."

Specifications. A Practical System for Writing Specifications for Buildings. By W. Frank Bower. Published by Edward A. MacLean, 14 Lafayette Place, New York. 1896. Price, $5.

The purpose of this work is to furnish in ready shape a correct and comprehensive skeleton from which to prepare the specifications for all the work which would enter into a building. The arrangement of the work is excellent. It begins with a complete summary of the items to be considered, arranged in the order they would naturally follow in the writing. Following this is the detailed specification, printed on alternate pages, and elaborated as far as is possible for general conditions. On the odd pages, opposite the various items, are memoranda in regard to requirements, building laws, special data, strength of materials, etc. The book concludes with a very complete index. A volume of this sort can be of considerable value to an architect, and would be of service as a reminder to the contractor who might be so unfortunate as to be called upon to figure a building "complete" upon a loosely drawn or incomplete specification. Mr. Bower has accomplished what probably every architect at one time or another had wanted to undertake, namely, a compilation or combination of all his specifications, which should include the many items which are so apt to be forgotten in actual practise or figure as extras.

THE ARCHITECT'S USE OF COLOR.

WITH the use of color you may forego moldings and projections; you get their effect by other means. With color you shall put your lights and shadows where you choose, and, like another Joshua, command the sun to stand at your bidding, and, like Orpheus, you will "have made a lasting spring." Think of whole streets vibrating with harmonies of color, like the black cliffs by the sea-shore that stand over deep pools of brown and green water, and the short green velvet turf outlines itself sharply against the blue sky. It is within our reach, and, moreover, is profoundly sensible. Your glazed brick or tile is a piece of permanent color, wind-proof and rain-proof, and, so far as it goes, germ-proof. I should, perhaps explain that I advocate glazed material and intense colors in the streets of manufacturing and crowded towns where there is no other color. In the country, and in those favored cities where houses have gardens, where creepers hang in rich festoons, where the exquisite laburnum shakes a merry golden tassel at the dowager lilac, and the apples have a friendly rivalry with the pear trees over the way, the local building materials will probably supply us with color enough to set off and harmonize with the palette set by Nature. But in the street, where all the color there is is of man's own making, it should be full and strong.

It has been objected that the sheen on glazed surfaces would be a serious drawback. I do not think the few examples we have show this. The upper part of a corner shop in Oxford Street was covered with white glazed tiles, — a very trying test, — but a film of "London's Entire" settled on it in a very short time, and it required some adroitness to select such a position as should show the glaze. Indeed, of glazed surfaces our own plate-glass windows should hold out undimmed longest, and yet we know, by sad experience, how often they require to be cleaned. That corner shop was a lost opportunity. We travel all the way to Pistoja to see John Robbia's colored terra-cotta frieze to the hospital there; we pass by unremarked the frieze of uncolored terra-cotta to Heath's hat shop.

As to cost, the money wasted in idle profusion of column and balister and carving would defray the extra cost of a faience front, treated in sober common sense. As to the architect's use of color, what can be said beyond that his use of it should be large and broad? Indoors your color may be in picture form if you please; but out of doors you require effect, not detail — bands, diapers, amongst which the windows locate themselves without regard to pattern or symmetry. The pattern is valuable merely as a convenient system of gradation. Not that this should be held the final ideal of outside coloring: we may in time reach the modeled figures of Susa, our buildings clasped and fortified by allegorical supporters; we might impress to our service the romance and portraiture of our time.

Part of Jesus College, Cambridge, was built in many-colored bricks four hundred years ago. To describe the beautiful fusion of iridescent tints that Time's fancy has occupied itself in mingling, one must use the word "opal." The black headers have borrowed of the sky, of the grass, of their neighbors, and gleam as dark blue, green, and purple topazes; the yellow has borrowed of the red, and the red has taken toll of the yellow, till, under scrutiny, the pattern becomes shy and refuses to let itself be traced, though at half glance it seems obvious enough. The lichens contribute the russets, grays, and gold. In this gay heraldry the windows occur quite simply, and their quietude enforces the splendor of their setting. When our descendants shall be heading their letters with the year 2000 and more, they will treasure amongst their possessions at Oxford of the Middle Ages this amazing jewel of our own times. — *Halsey R. Ricardo, in the British Architect.*

THE article by Mr. George Hill on Fire-Proof Floor Arches, which is resumed in this number, will be concluded in the June or July number. The closing chapters of this series contain some thirty-three illustrations of the tests that have been made under Mr. Hill's directions.

The Resistance of Brickwork.

SOME very interesting and valuable experiments have recently been made in England under the direction of the Royal Institute of Architects, with the object of determining the resistance to crushing of brick piers.

The tests were made under the supervision of the Science Standing Committee of the Institute, consisting of Messrs. Burrows, Street, and Clarke, and Professor Unwin. The names of these gentlemen are so well known throughout the architectural world as to give an added value to the results of the tests. Fig. 1 is a diagram illustrating the construction of the machine in which the piers were tested, which consisted essentially of two wrought-steel riveted columns, connected above and below by heavy riveted plate girders. Upon the lower girder was placed a hydraulic ram 3 ft. 1⅞ ins. in diameter, and of 1,130 sq. ins. in area. In order to determine the true crushing effect of the ram due to any gauge pressure, careful preliminary tests were made by crushing cylinders of copper of very uniform quality, which had previously been tested in one of the technical colleges, and the compressions corresponding to different loads accurately determined. This was quite essential, as in the case of so large a ram it was quite probable that a considerable amount of gauge pressure would be expended in mere friction. In fact, the preliminary tests showed that the loss in this respect ran up considerably over 10 per cent. for loads of 50 tons.

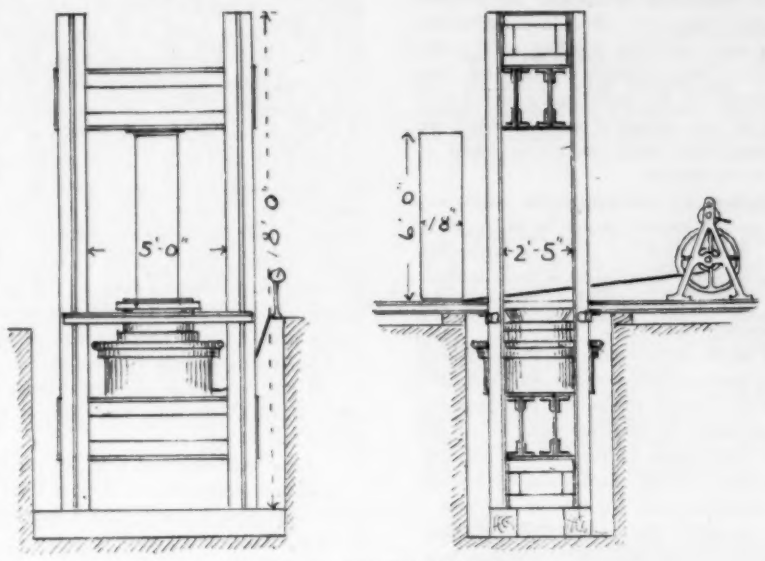


FIG. 1. TESTING MACHINE.

The upper part of the ram was provided with a cup and ball bearing, upon which the brick piers were placed, bearing directly against the under side of the upper girder. The whole of the steel work of the machine was so proportioned that a pressure of 500 tons could be safely exerted on any specimen, this corresponding to a water pressure of about 1,000 lbs. to a square inch.

The experiments finally decided upon were confined to the following varieties of brick, as affording types of the best kind most generally found in England:—

1. London stocks.
2. Gault.
3. Leicester red.
4. Staffordshire blue.

London stocks are yellow brick, hand-made; quite an ordinary brick, and, we should say, by rough comparison, about like what we call light hards in this country. The Staffordshire blues are hard, well-burned bricks, machine pressed.

The piers were built upon wrought-iron plates 2 ft. by 2 ft., 6 ins. by ½ in., resting upon a line of rails leading directly to the testing machine, so that they could be drawn into the machine without being disturbed. Two piers of each kind of brick were tested, the bricks in one being laid up in Portland cement mortar, and the bricks in the other in gray lime mortar. The cement mortar was mixed by measure in the proportion of 1 of cement to 4 of washed river sand; and the lime mortar, 1 to 2. Each pier was about 18 ins. square and 6 ft. high. The brickwork was started upon a bed of mortar of the thickness of an ordinary joint, and was finished with a layer of mortar, upon which a sheet of felt was laid to prevent the top courses deteriorating from heavy rain, the work all having apparently been done in the open. It is interesting to note that, notwithstanding the care taken in building these piers, the committee in charge experienced the very difficulty which is the constant worriment of the architect in actual practise. The labor was supplied by a large firm of contractors. During the absence of members of the committee, the bricklayers, finding the Leicester red and Staffordshire blue bricks very hard to cut, filled in a great portion of two piers with closers of London stocks which quite destroyed the value of the piers, so that fresh ones had to be built.

After making the first test it was discovered that the head of the testing frame was not perfectly true, and a lead casting was made to fit the concavity, held in place by sheet iron and iron clips. Also on the head of each pier tested there was placed a sheet of felt and one of iron 1-16 in. thick, so that the pressure may be considered to have been fairly well distributed.

All of these tests are very fully reported in the *Journal of the Royal Institute of British Architects*, together with a mass of material and data which is exceedingly interesting in many respects. The following table will illustrate the thorough manner in which all the tests were made.

PIER NO. 15. STAFFORDSHIRE BLUE BRICKS, FROM ROWLEY REGIS, IN CEMENT MORTAR, WIRE CUTS, NO FROGS.

6 ft. high, 13⅜ x 13⅜ ins.; sectional area 1.265 sq. ft. Built 1st August; crushed 31st December. Age, 21.7 weeks.

TIME.	Pressure on Gauge. Pounds per Square Inch.	Total Real Pressure in Tons.	Pressure per Square Feet of Pier in Tons.	Compression in Inches.	NOTES.
12.25	10	.14	.11	. . .	Bearing tight before starting.
12.28½	70	27.29	22.12	. . .	Sounds of cracking heard.
12.29½	90	37.26	29.45	. . .	Cracking top three courses.
12.30	110	46.54	36.79	3/16	
12.30½	120	51.18	40.46	¼	Cracking top five courses.
12.31	130	55.82	44.12	5/16	Cracking at bottom.
12.32	160	69.74	55.13		Cracking at bottom, five courses.
12.32½	180	79.02	62.46	⅜	Two cracks at bottom, six courses up.
12.33	200	88.30	69.80	7/16	Crack, ten courses down from top.
12.33½	210	92.94	73.47	. . .	Crack opening top and bottom.
. . . .	220	97.58	77.13	½	
12.34	230	102.22	80.80	9/16	Pier splitting up.
12.35	240	106.86	84.47	⅝	Crack well opened, and pier broke entirely into a heap of rubbish. Not a whole brick could be found. Cement was still damp.

The following is a comparative statement of the results of all the tests. It should be borne in mind that these represent the results of a first series of experiments. All the piers were from twenty to twenty-two weeks old, during which time the mortar had a chance to thoroughly set. A subsequent set of tests are to be made on piers

which have set up for ten months, the results from which will be watched with a great deal of interest.

COMPARATIVE STATEMENT OF RESULTS.

No. of Pier.	Description of Brick.	Age. Weeks.	Commencement of Failure. Tons per Square Foot.	Final Collapse. Tons per Square Foot.
*1	London Stocks in mortar (with a frog) .	17.7	....	....
2	London Stocks in mortar (with a frog) .	18.3	4.18	10.41
3	Gault in mortar (without frogs)	18.3	5.00	21.82
4	Gault in mortar (without frogs)	18.8	6.16	22.03
5	Leicester Red in mortar (without frogs) .	19.1	15.20	29.93
6	Leicester Red in mortar (without frogs) .	18.6	16.11	31.55
7	Staffordshire Blue in mortar (without frogs)	18.6	22.43	69.22
8	Staffordshire Blue in mortar (without frogs)	19.4	21.42	79.39
9	London Stocks in cement (with a frog) .	21.1	7.22	16.03
10	London Stocks in cement (with a frog) .	21.0	5.72	13.83
*11	Gault in cement (without frogs)	21.0	6.98	17.98
*12	Gault in cement (without frogs)	20.5	7.08	17.51
13	Leicester Red in cement (without frogs) .	22.1	17.87	67.36
*14	Leicester Red in cement (without frogs) .	21.7	21.82	49.54
*15	Staffordshire Blue in cement (without frogs)	21.7	29.45	84.47
*16	Staffordshire Blue in cement (without frogs)	22.7	16.91	61.14

Duplicates of the piers marked * have been built, and will be tested for the four months' period.

Tests were also made of the strength of the individual bricks as well as of lime and cement briquettes, mixed in same manner as the actual mortar used in the piers. The strength of the bricks is as follows: —

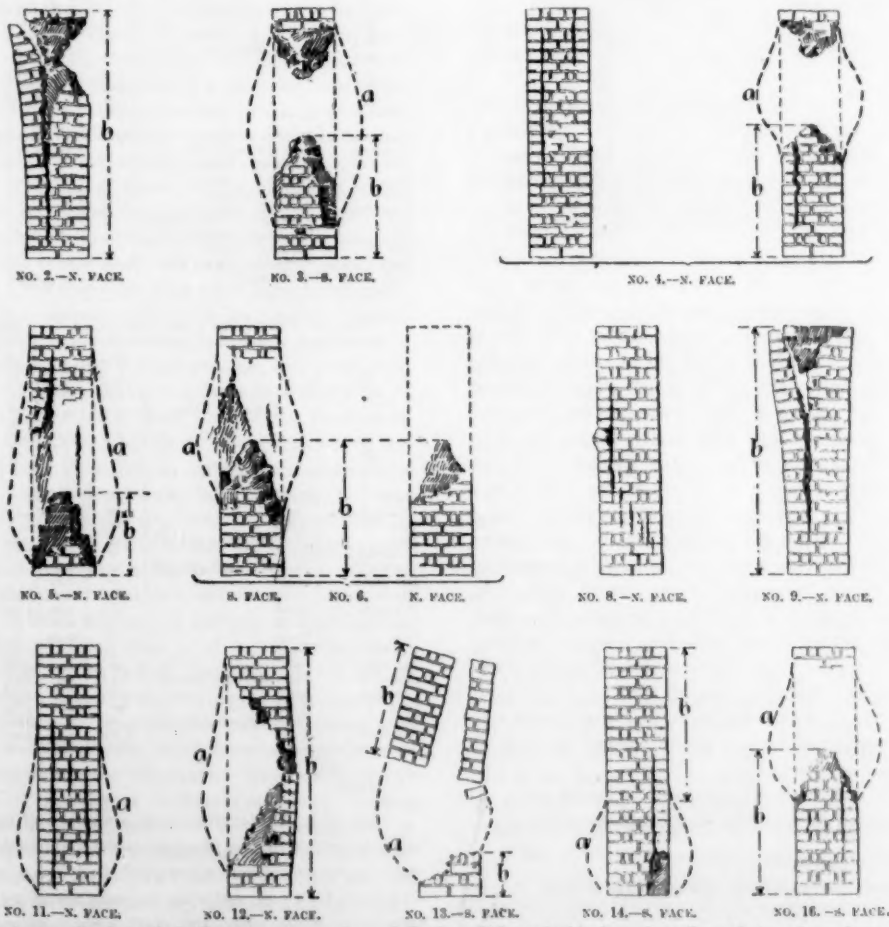
	Crushing strength in tons per square foot.		Crushing strength in tons per square foot.
London Stocks . .	84.27	Leicester Red . . .	382.1
Gault	182.2	Staffordshire Blue. .	701.1

These strengths were ascertained by Professor Unwin by his tests at the Central Technical College, where were also tested the briquettes with the following results: —

LIME BRIQUETTES. Strength at 4 weeks, 6.08 tons per sq. ft.
Strength at 12 weeks, 8.73 tons per sq. ft.
Strength at 24 weeks, 15.72 tons per sq. ft.

CEMENT BRIQUETTES. Mean strength of briquettes made with same sand as that used in building the piers, 29.00 tons per sq. ft. at 24 weeks.

The diagrams in Fig. 2 were reproduced from drawings made on the spot by Mr. Matt. Garbutt. In his report, Mr. Garbutt states that "The observed effects of pressure were similar in most cases, but varied in degree with the different materials. Generally the first evidences of strain were slight internal crackling sounds, audible only on applying the ear to the brickwork. Then the mortar squeezed out of the joints and fell off — this occurring to a greater extent with the harder bricks, and being more marked where lime mortar was used than with cement. This was accompanied or followed by cracks occurring in single bricks which, from slightly irregular bedding, or other cause, were unevenly stressed, and by the spalling off of small corners or pieces of the face for similar reasons. By this time, the joints were generally noticeably compressed, and serious cracks,



a . . . a, Approximate outline during final collapse. b . . . b, Portions which remained in shape after collapse of pier. Approximate scale of 4 ft. to 1 in.

FIG. 2. DIAGRAMS SHOWING WAYS IN WHICH PIERS FAILED.
Reproduced from illustrations in the *Journal of the Royal Institute of British Architects.*

indicating final lines of rupture, appeared. The piers at this point generally bulged outwards, slowly at first, and then, the resistance of the brickwork ceasing, the falling of the pressure gauge gave warning that actual collapse was imminent. In the case of the harder bricks set in cement the final failure was much more sudden than in the others, so much so that some agility was necessary on the part of the man who, to measure its compression, stood close to the pier. It will be desirable, before carrying out the proposed nine-month tests, to devise an instrument for measuring, without undue risk to the observer, the actual shortening of the piers during testing."

Pier No. 15, the results of the test of which we have previously quoted, was only 13½ ins. square. Being smaller than the others, it was feared the machine would not have sufficient power to crush the Blue bricks in cement. It was found to be 25 per cent. stronger in proportion in its area than the 18 in. pier, the difference being probably due to the better bonding and absence of closures. It failed entirely by crushing, and was so completely destroyed that not a whole brick remained. The cement was still damp at the time of failure.

Judging from the discussion which took place in the Royal Institute following the presentation of the reports of the committee which conducted the foregoing tests, it would seem to be evident that either we overload our brickwork in this country, or else brick masonry in England is of a very low comparative order. Professor Unwin, in the course of his remarks, stated that according to the best of his knowledge the limits of working stress which have been allowed in English brickwork in cases where it is required to carry a heavy load are something like this: —

For bricks in lime mortar, not more than from 2 to 4 tons per square foot.

For bricks in cement mortar, not more than from 4 to 7 tons per square foot, and for specially selected hard brick in cement mortar, from 7 to 8 tons per square foot.

It will be seen that the maximum strength, according to Professor Unwin, which is permissible upon English brickwork, only equals what we put upon the very poorest kind of brickwork in this country. It was further stated that the factor of safety in brickwork should be about 20. This ratio in piers, such as the one reported in detail, would indicate a maximum safe load of only 4.2 tons, or, as all the reports of the English tests are made in tons or 2,240 lbs., the equivalent strains in American tons would be 4.7 tons per square foot. This, be it understood, is for a construction which employed a very hard brick having an ultimate crushing resistance of from 600 to 1,000 tons per square foot, and which is laid up in cement mortar; whereas in Boston, with light hard bricks, which generally means pretty poor brick, too, and laid up in lime mortar, we are supposed to be perfectly safe when we load with nearly 5 tons per foot. Either the American practise is wrong, or the English brick and mortar makers are wofully at fault. In nearly all the tests it was found that the first yielding was on account of the mortar being squeezed out of the joints, and yet the resistance of the lime mortar briquettes ran up to nearly 16 tons per square foot. It is interesting to note that Professor Unwin, in speaking of the tests of brickwork, admits that the American brick is very much stronger than what is used in England, and another speaker following him, Mr. Walker, author of "Brickwork," testifies that American bricks are infinitely better and much harder, as a rule, than English brick.

The Boston building law, which was prepared entirely under the direction of perfectly competent experts, allows stresses in tons of 2,000 lbs. per square foot as follows: —

First-class work, of hard-burned bricks, and including piers in which height does not exceed six times the least dimensions, laid in —

(*a*)	One part cement, two parts sand	15
(*b*)	One part cement, one part lime, and eight parts sand	12
(*c*)	Lime mortar	8

Brick piers of hard-burned bricks, in which height is from six to twelve times the least dimension.

Mortar "a"	13
Mortar "b"	10
Mortar "c"	7

For "light hard" bricks, stresses not to exceed two thirds of above.

Let us compare some of the results which have been obtained by testing of individual bricks. In THE BRICKBUILDER of November, 1894, was reported the results of some tests made at Watertown upon some Eastern hydraulic pressed bricks. The tests were made upon single bricks, the pressed surfaces being faced with plaster of Paris to secure even bearings in the testing machine. The average of twelve tests on whole bricks showed an initial yielding at 10,755 lbs. per square inch, or 775 tons per foot, with ultimate strength of 950 tons per foot. There were also a number of tests made in 1887 and 1888 by a committee of the American Society of Civil Engineers. These tests were quoted in the *Journal of the Royal Institute*, and the results were reduced to the English standards. The bricks themselves were of three kinds: —

	Crushing strength. Tons per square foot.
Hard burned face bricks	890
Hard burned common bricks	1170
Bay State medium bricks	730

Thirty-three brick piers were built of these bricks of various forms and sizes, and were all tested at Watertown. The results of the tests are given by the following table: —

BRICK PIERS IN CEMENT MORTAR.

Kind of Brick.	Mortar.	Form of Pier.	Nominal Size in Inches Square.	Area of Section in Square Feet.	Height in Inches.	No. of Courses.	Thickness of Joints.	Age in Months.	Crushing Pressure in Tons per Square Foot.
Common	1 Portland, 2 sand	Solid.	16	1.56	121	49		24	121
Common	1 Portland, 2 sand	"	12	0.95	120	58		24	128
Face	1 Portland, 2 sand	"	13	0.91	119	51	½	23½	144
Face	1 Portland, 2 sand	"	8	0.40	80	35	½	23	144
Face	1 Portland, 2 sand	"	12	0.92	23½	10	½	18½	234
Common	1 Portland, 2 sand	"	16	1.77	23½	13	½	18½	Not given.
Bay	1 Rosendale, 2 lime, 6 sand	"	12	1.00	73½	30	½	20½	105
Bay	1 Rosendale, 2 sand	"	12	1.00	72½	30	½	20	126
Bay	1 Portland, 2 sand	"	13	1.00	72½	29	½	20	115
Bay	1 Portland, 2 lime, 6 sand	"	12	1.00	73½	30	½	20½	91
Bay	Neat Portland	"	12	1.00	72	30	½	19½	152

BRICK PIERS IN LIME MORTAR (1 LIME AND 3 SAND).

Kind of Brick.	Form of Pier.	Nominal Size in Square Inches.	Area of Section in Square Feet.	Height in Inches.	No. of Courses.	Thickness of Joints.	Age in Months.	Crushing Pressure in Tons per Square Foot.
Face	Solid	8	0.595	....	7	....	15	163
Common	Solid	8	0.420	....	7	....	15	156
Face	Solid	12	0.92	....	10	....	18½	125
Face	Hollow (Space 4½ x 4½)	12	0.79	....	10	....	18½	128
Common	Solid	12	0.96	....	10	....	18½	158
Common	Hollow (Space 4½ x 4½)	12	0.83	....	10	....	18½	131
Bay State	Solid	12	1.01	....	10	....	18½	88
Bay State	Solid	12	1.00	72½	30	½	19½	73
Bay State	Solid	12	1.00	72½	30	½	20	85
Bay State	Solid	12	1.08	73	19*	1	20	78
Face	Solid	8	0.40	80	35	½	23	120
Bay State	Solid	12	1.00	94½	39	½	23½	75
Bay State	Solid	12	1.00	119½	49	½	23½	59
Common	Hollow (Space 4½ x 4½)	12	0.80	120½	50	½	24	101
Common	Solid	12	0.96	117½	49	½	24	76
Face	Solid	12	0.92	119½	52	½ to ⅝	24	97
Face	Hollow (Space 4 1/16 x 4 1/16)	12	0.80	119½	52	½	24	115
Bay State	Solid	12 x 16	1.33	120½	49	½	24	50
Bay State	Solid	8 x 12	0.66	120½	49	½	24	60

* On edge.

Mr. F. E. Kidder also made a number of tests in 1882 at Watertown, in behalf of the Massachusetts Charitable Mechanics Association, the results of which are published in his handbook. The piers were 8 in. by 12 in. and nine courses, about 22½ ins. high, and the tests were made when the piers were four months and twenty-six days old, about the same age as the London tests. The following table gives the results of the tests: —

8 IN. BY 12 IN. PIER. COMMON BRICKS LAID IN	Ultimate strength of pier.	Pressure per square inch under which pier commenced to crack.	Ultimate strength per square inch.	Tons per square foot.
	lbs.	lbs.	lbs.	
Lime mortar	150,000	833	1,562	112
Lime mortar, 3 parts; Portland cement, 1 part	290,000	1,875	3,020	217
Lime mortar, 3 parts; Newark and Rosendale cements, 1 part	245,000	1,354	2,552	184
Lime mortar, 3 parts; Roman cement, 1 part	195,000	1,041	2,030	146
Portland cement, 1 part; sand, 2 parts	240,000	1,302	2,500	180
Newark and Rosendale cements 1 part; sand, 2 parts .	205,000	708	2,135	153
Roman cement, 1 part; sand, 2 parts	185,000	1,770	1,927	148

One cannot study the foregoing tables and the results of the British experiments without being struck by the wide variation in results; and the tests of the Society of Civil Engineers seem also to indicate that, on the whole, the quality of the mortar is not an essential element of the strength of the pier, for the average resistance of a pier laid up in Portland cement mortar is 147½ tons per square foot, while the average of piers laid in lime mortar is about one hundred tons. The difference is far less than one would suppose, judging from the results of tests on lime and cement mortar without the bricks. The fact is, the chief role of mortar in a masonry construction is to serve as a matrix for the bricks, and all of these tests emphasize the necessity of the joints being evenly and fully filled. The report of the English tests calls attention to the preliminary cracking noise when pressure was applied upon the piers, indicating a gradual subsidence of the irregularities caused by mortar not being properly applied. It would, of course, be impossible to reason out the strength of the pier from the resistance of the individual brick. It would also be equally inadvisable to reason out the strength from the resistance of the mortar itself. It is probable that had the tests of the Society of Civil Engineers been made upon larger piers, the unit resistance of the brickwork would have been greatly reduced, for it seems to be a pretty well established fact that a small pier is much stronger per square foot than a large one, due, undoubtedly, to the impossibility of getting an even bearing and even distribution of the weight over a large surface made up of a number of small parts.

The comparative tests, both English and American, show that the average English brickwork is not as reliable as corresponding work in this country. The London Stocks brick is not of sufficient strength to be used safely in any building under such conditions as prevail here, and the best of the bricks quoted do not give as good results as we obtain from our common hard-burned bricks. On the other hand, it is to be doubted if brickwork as habitually laid by our masons, if loaded to the limits allowed by our Boston building law, has a factor of safety of more than 4 or 5. It surely hasn't anything like the factor of 20, which Professor Unwin recommends, and before we can speak with surety upon how much it is safe to trust our brickwork with, there must be more exhaustive tests conducted in a similar manner to those which have been quoted from abroad, but upon piers at least 2 ft. square. This would require a testing machine of a capacity of at least 1,000 tons. Such a machine does not exist anywhere, and could not be constructed so as to be of scientific value without a great expense. So that, until some person or some society is ready to make tests of this sort and has the proper funds at their disposal, we shall have to be content with trusting very largely to luck in our masonry construction, if we are to load it up to the limits which in this country seem to be considered safe.

C. H. BLACKALL.

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

FIRE-PROOF FLOOR ARCHES.

BY GEO. HILL, C. E. (*Continued.*)

CLAY ARCH TESTS.

THE author designed a hydraulic transverse testing machine, which was built for him by the Watson & Stillman Hydraulic Works, in the following manner (see Fig. 29a): A 15 in. I beam, 80 lbs. per foot, 7 ft. 9 ins. long, was used as the principal member. It was supported above the I beams, which form the skewbacks of the arches by means of two pairs of wrought-iron clamps. On one end of the large beam a small hydraulic pump was placed, and connected to the pump by a long coil of copper pipe was a ram for putting pressure on the arch. The pump was ⅞ in. in diameter of piston and 2¾ ins. stroke, and one man could get a pressure of 1,500 lbs. per square inch, or 75,000 lbs. on the arch, quite easily. It

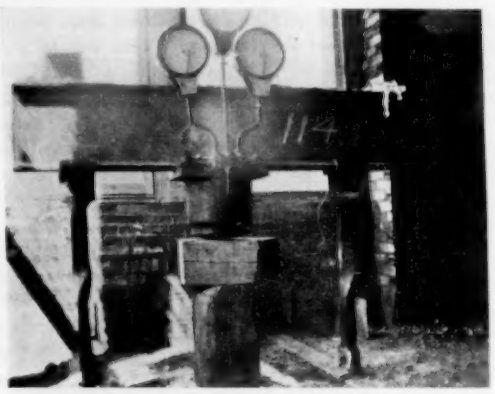


FIG. 29a.

was one of the standard Watson & Stillman pumps with brass valves, and never gave the slightest trouble. Once in the middle of the test some sticks became mingled with the oil which was used instead of water in order to prevent freezing, and one of these small sticks lodged under the valve; the valve was taken out, cleaned, and replaced without any difficulty whatever. The ram was of 7 in. stroke, about 8 ins. in diameter, and exactly 50 sq. ins. in area, and had the bottom crowned about ⅝ in. It was set in a cast-iron body and was packed with leather. It was arranged to hang on the under flange of the 15 in. I beam by means of a couple of clamps, which could be tightened on it, and could be slid along to any desired position on the beam. To the upper part of the chamber of the plunger a set of three valves was connected, to which three Bristol pressure-recording gauges were attached. One had a range of 3,000 lbs., one of 1,500 lbs., and one of 400 lbs. per square inch. The readings were, therefore, to be multiplied by the area of the piston, or 50, to get the actual pressure exerted. The dials were rotated by clocks, making one revolution per hour, and so both the amount and the rate of the application of the load were recorded graphically. Two gauges were used in conjunction at all times, thus checking one another. In the tests made they always agreed closely.

Tile Arch Tests.— These were tests of a series of arches, some of which were built at the works of the Staten Island Terra-Cotta Lumber Company, but the majority by the Raritan Hollow and Porous Brick Company, at various times during the winter of 1894–95 and the summer of 1895.

Test No. 76.— This was made on a hollow tile end-construction

arch 7½ ins. deep and of an effective depth of about 6 ins., made of hard tile and laid up without any mortar, one block wide. This arch is shown in Fig. 30. The clay blocks were fitted in place over a temporary center and then the key block put in and wedged as well as it could be, but owing to irregularities of the material this could not be very satisfactorily accomplished. The pressure was continuously applied, and at 5,000 lbs. the key at the upper portion split in a plane parallel with the tie-rod. At 6,250 lbs. the skewback on the right-hand side cracked, and a spall flew off the middle voussoir on the right-hand side of the key. At 9,000 lbs. the arch failed along the wavy lines shown. The application of the load was by means of planking leveled up with sawdust over the top of the arch, so as to effect a practically uniform distribution of the loading.

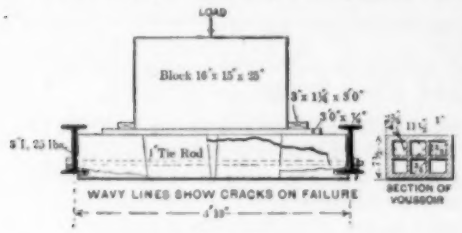


FIG. 30.

Test No. 77.— This was of a side-construction or old style arch laid up dry like No. 76, and of hard tile. Its construction is shown in Fig. 31. The pressure was applied as shown, there being a slight leveling of sawdust under the planking. There was no perceptible effect until the load reached the maximum of 2,500 lbs., when the arch suddenly collapsed by shearing off the voussoir next the skewback at the point shown. The arch was composed of one course of voussoirs laid up dry; the load was practically uniformly distributed.

Test No. 78.— This was similar in all respects to No. 77, except that in this case, not only the voussoir next the skewback, but the skewback itself, failed by shearing.

Test No. 79. — This was of a hard tile end-construction arch which had been built for some time, and had for several months carried a pile of brick weighing 12,000 lbs. uniformly distributed over it. A little sand was sprinkled over the top, and the load was applied over an area of 9 by 48 ins., or 3 sq. ft., in the center. The point of application of the load was over one of the central longitudinal divisions, and as each one of the blocks composing the arch was about 1 sq. ft. in area, two rows of blocks received the loading. As the load was applied the arch continually deflected until the maximum of 13,750 lbs. was reached, after which continued pumping resulted in a decrease in the amount of the load. The cracking of the various courses is shown in Fig. 32, which does not, however, show how markedly the top horizontal section of the arches was sheared off, showing that it acted truly in compression. There was a certain amount of elongation of the tie-rods, but they remained intact. This arch had an effective depth of 4 ins., the balance being below the skewback, and acting simply as fire-proofing for the upper section. In a plane perpendicular to the line of pressure, the section through the arch would show a top horizontal and a bottom horizontal member, a middle horizontal member, and in each block three or four vertical members. The arch was laid up in a mixture of one part Portland cement and two parts sand, and over the top of it was a leveling of the same mortar about ½ in. thick; when taken off, chips of the blocks adhered to this, showing that the tile section was reinforced by about this same amount.

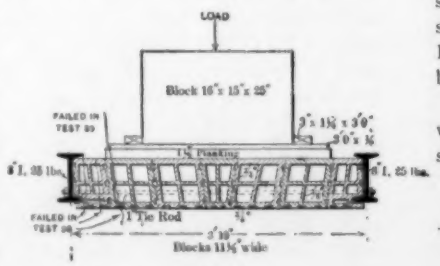


FIG. 31.

Test No. 80. — This was of an end-construction arch, nominally 10 ins. deep, and of 5 ft. 5 ins. span, 4 ft. 2 ins. wide, with an effective depth of about 7¾ ins. The tie-rod was so placed as to be 2½ ins. above the bottom, thus reducing the distance from the center of the tie-rod to the top of the arch to 6 ins. The section of the voussoirs, which were of hard tile, is shown in Fig. 33. Blocking was so placed over the arch as to distribute the load uniformly over it, and then the pressure was gradually applied until the machine clamp broke at 57,500 lbs. At 40,000 lbs. a slight crack appeared in the bottom of one of the skewbacks running out horizontally from the bottom. At 40,500 lbs. the bottom of the joint of the key block on the left-hand side opened ⅛ in., and on the right-hand side it opened $\frac{1}{16}$ in. At 42,500 lbs. the top began to spall a very little at the center. After the clamp broke the cracks on the arch all closed, and the only evidence that it had been subjected to load was a spall the size of a thumb-nail at the top corner of one of the blocks, and a small crack at the skew in one of the others. This arch was laid in Portland cement mortar, and had set twenty-four hours when tested, but the temperature had been so low that the mortar had frozen.

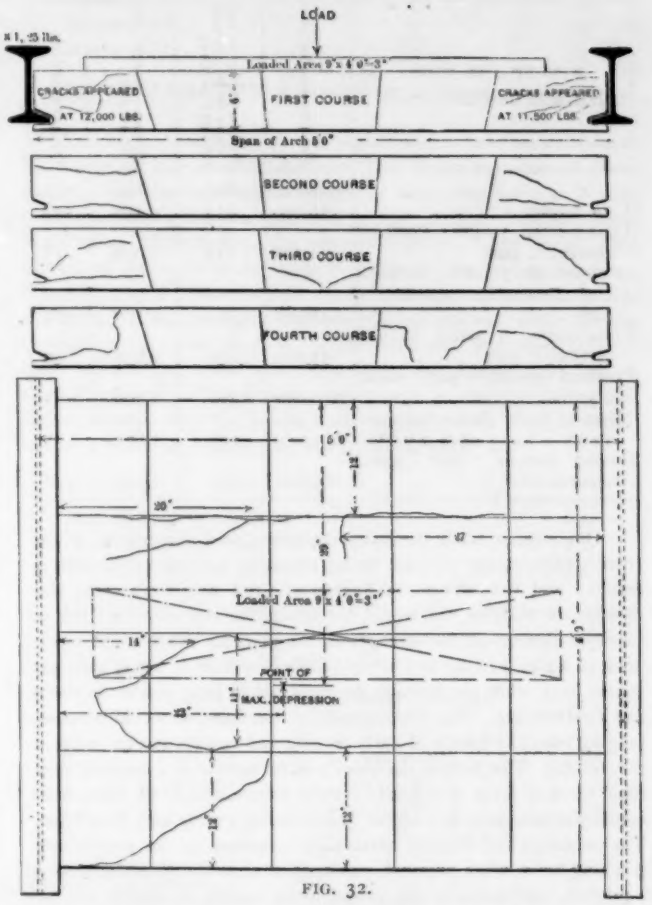


FIG. 32.

Tests of Arches Built for the Purpose. — Table No. 3 gives the weight and composition of these arches. They were laid up in a strong Portland cement, and had about three months in which to set.

TABLE NO. 3.— SPECIAL ARCHES FOR TESTING.

TEST NUMBER.	81	82	83	84	85	86	87	88	89
Depth of block, inches	8	8	8	8	10	10	12	8	8
Weight of block alone per square foot, pounds	31.3	32.1	36.1	32.5	41.6	40.3	45.0	34.8	32.6
Weight of arch, per square foot, pounds	42.6	42.3	47.4	44	57.5	53.8	57.4	47.0	42.7
Weight of blocks, total, pounds	469.25	481.5	531.5	493.25	624	620.75	769.5	550	514
Weight of sand, pounds	86	78	83	88	116	102	110	96	82
Weight of cement, pounds	68	60	66	70	97	84	82	77	63
Weight of water, pounds	32	30	32	34	49	42	44	38	32
Total weight, pounds	655.25	649.5	712.5	685.25	886	848.75	1005.5	761	691
Total weight, less half water, pounds	639.25	634.5	696.5	668.25	861.5	827.75	983.5	742	675

Test No. 81.— This was a hard tile side-construction arch with 8 in. blocks, the effective height of the arch being 7 ins. It was laid in Portland cement with a leveling of about $\frac{5}{16}$ in. of cement on top; the load was applied near the center on an area of 10 by 12 ins. (see Fig. 38). The tying was done by hook rods placed as shown. At 5,250 lbs. the first crack appeared, and the key opened about $\frac{1}{16}$ in.;

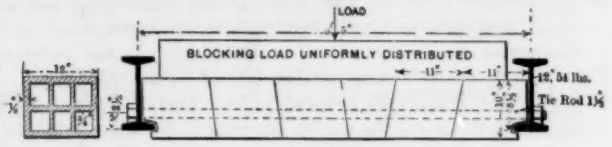


FIG. 33.

at 8,750 lbs. the crack opened wider, and cracks appeared at the left skewback, opening wide; at 10,000 lbs. the arch collapsed, and cracks appeared at the left skewback; there was a crushing in of the voussoir along its entire length under the right-hand edge of the block on which the load was applied.

Test No. 82.— This was a side-construction hard tile arch, shown in Fig. 34. The loaded area was 7½ by 41 ins. The load was continuously applied; at 5,000 lbs. there was a slight opening of the skewback; at 5,700 lbs. there was a failure of the east skewback by shearing. Fig. 39 shows the nature of the failure.

Test No. 83. This was of an arch of hard tile end construction, with porous terra-cotta solid skewbacks; the effective height of the arch was 5¾ ins., although the blocks were nominally 8 ins. There was $\frac{5}{16}$ in. finish of mortar on the top, and the load was

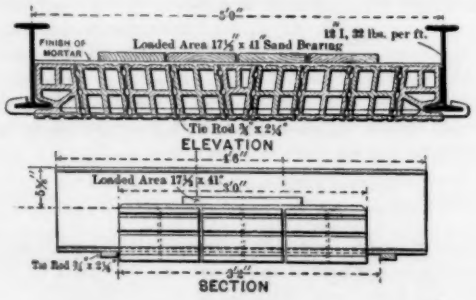

Finish of Mortar
Loaded Area 17½" x 41" Sand Bearing
12 I, 32 lbs. per ft.
Tie Rod ¾" x 2¼"
ELEVATION
Loaded Area 17½" x 41"
Tie Rod ¾" x 2¼"
SECTION

FIG. 34.

applied on an area of 10 by 13 ins., as shown in Fig. 35. At 5,000 lbs. there was a slight hair crack at the junction of the skewback block with the skewback I beam, and a slight crack at the right-hand side and bottom of the key block. There also appeared a slight hair crack in the mortar cover of the top of the arch. At 6,250 lbs. the crack on the right-hand side of the bottom key opened $\frac{3}{32}$ in., and the top surfacing began to crack. At 7,500 lbs. it cracked

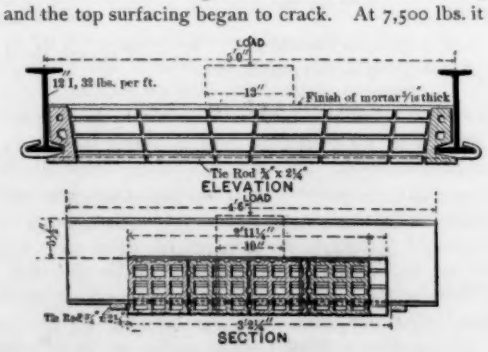


FIG. 35.

in the middle and rose, and the crack in the key opened ⅛ in. At 8,750 lbs. the top cover bulged further, and the arch opened ⅜ in. at the bottom of the key. At 10,000 lbs. the top surfacing had bulged 1 in., and the plaster began dropping out (see Fig. 40). At the left-hand end of the arch, the joint between the skewback block and the end-construction block opened, and at 11,250 lbs., the maximum load, the arch practically failed, the top cover bulging and cracks radiating out in it from each corner of the block on which the pressure was

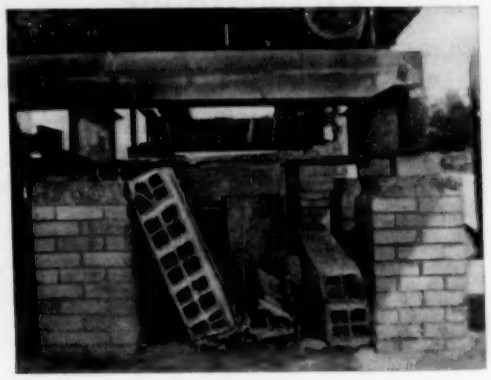


FIG. 38.

applied, at an angle of about 45 degs. with lines drawn perpendicular and parallel to the skewback beams. The pumping was renewed, when the bottom of the skew dropped off at the left-hand end, being

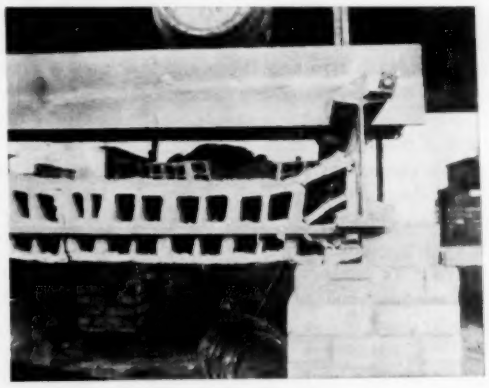


FIG. 39.

sheared through. Then the two east skews, or the parts of the skews which protected the bottom flange of the I, dropped off, and a spall appeared in the bottom of the first voussoir away from the

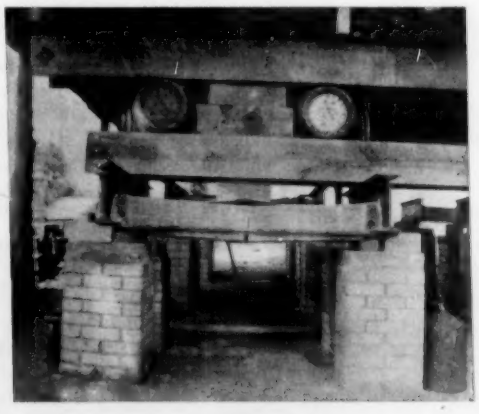


FIG. 40.

skew, at the left-hand end. At the right-hand end the flange protection dropped off, and cracks appeared running to the right and left from the upper half of the lower hole in the skewback block.

(*To be continued.*)

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VI.

(Continued.)

THE CHEMISTRY OF CEMENTS.

IT is as quick to combine with silica as is lime. During calcination it parts with its carbon dioxide at a lower heat than is required for the expulsion of that acid from the lime, and becoming caustic in advance of the lime, is the first to attack the silica, freeing the latter from its combination with alumina, thus rendering the silica as free silicic acid, and if the high heat is continued; a reaction takes place, and chemical combination ensues between the acid and the three bases, in accordance with their atomic weights, as fully illustrated in the table of combining ratios.

A simple illustration of the fact that the reaction follows the separation of the alumina from the silica, and a chemical combination with the acid and all the bases takes place, is afforded by the following experiment: —

First. Take a piece of magnesian cement rock and from it secure two pieces weighing one or two pounds each, and after they have been gradually dried out, to prevent what is known by kiln men as "popping," which is caused by a bursting into small pieces through the sudden conversion of the moisture contained in the rock into steam, place both these pieces in a smith's forge and rapidly drive them up to nearly a white heat, then suddenly withdraw one of the pieces from the forge, and as quickly as possible crush it to powder while hot.

Second. Continue the heat with the other piece for half an hour or so, then stop the blower and allow the piece to cool gradually, keeping it covered in the forge until it is cold, then crush to powder.

Third. Keep the two samples separate and wet them into balls, patties, or briquettes, and note the difference in the action of the two. The first will heat, expand, and check, and if placed under water will become of a mud-like consistency, and if in air, it will crumble into dust-like ashes; while the second sample will not heat, will not expand or check, and after an hour in air will sustain submersion and become hard.

The first sample was withdrawn from the heat after the expulsion of the carbon dioxide, and before it had time for the reaction and formation of silicates, and the constituents were in a free condition, as shown by the heat and expansion when hydrated, while the second sample was accorded the necessary time for such reaction and chemical combination; thus proving the truth of our assertion, that whenever present with silica and lime, and under high and continued heat, both magnesia and alumina combine with the silicic acid in precisely the same manner as lime combines, in certain fixed proportions, according to the law of atomic weights.

A table of the atomic weights of such elements as are found in hydraulic cements is herewith given. The numbers indicate the relative weights of the atoms constituting the elements.

Elements.	Symbol.	Atomic Weight.
Alumina	Al.	27.
Calcium	Ca.	39.9
Carbon	C.	11.97
Hydrogen	H.	1.
Iron	Fe.	55.9
Magnesium	Mg.	23.9
Manganese	Mn.	54.8
Oxygen	O.	15.96
Kalium (Potassium)	K.	39.03
Sulphur	S.	31.98
Silicon	Si.	28.
Sodium (Natrium)	Na.	22.99

Although the system employed in calculating the percentages of the various chemical combinations which occur in hydraulic cements is familiar to many, yet a desire has been expressed that it be illustrated in a plain and practical manner, which may be readily understood by those who have little time to devote to such study, and for this reason a place is given to the following calculations.

SILICATE OF LIME.

Silica (SiO_2) is a chemical combination of silicon and oxygen in the proportion of one atom of silicon (Si) to two atoms of oxygen (O).

By reference to the table, it will be seen that the atomic weight of silicon is 28., and that of oxygen is 15.96. Two atoms of oxygen will therefore weigh 31.92.

Thus, 28. + 31.92 = 59.92 = silica. By dividing each number by 59.92 we get the percentage of each.

$$\left.\begin{array}{l} 28.00 \div 59.92 = \text{Silicon } 46.73 \\ 31.92 \div 59.92 = \text{Oxygen } 53.27 \end{array}\right\} = 100 \text{ Silica } (SiO_2).$$

Employing the same method with reference to lime (CaO) we find that the atomic weight of calcium is 39.90, which, being added to one oxygen 15.96 = 55.86 = lime.

$$\text{Therefore } \left.\begin{array}{l} 39.90 \div 55.86 = \text{Calcium } 71.43 \\ 15.96 \div 55.86 = \text{Oxygen } 28.57 \end{array}\right\} = 100 \text{ lime (CaO).}$$

Silicate of lime is formed by a combination of silica and lime in the proportion of one part of the former to two parts of the latter, the combining numbers of which are as already given.

$$\left.\begin{array}{l} 1 \text{ Silica} = 59.92 \\ 2 \text{ Lime } (55.86 \times 2)\ 111.72 \end{array}\right\} = 171.64.$$

$$\left.\begin{array}{l} 59.92 \div 171.64 = \text{Silica } 34.91 \\ 111.72 \div 171.64 = \text{Lime } 65.09 \end{array}\right\} = 100 \text{ Silicate of Lime } (2\ CaO, SiO_2).$$

CARBONIC ACID.

$$\left.\begin{array}{l} \text{Carbon (C) } 11.97 \\ 2 \text{ Oxygen (O) } 31.92 \end{array}\right\} = 43.89.$$

$$\left.\begin{array}{l} \text{Carbon } 11.97 \div 43.89 = \text{Carbon } 27.27 \\ \text{Oxygen } 31.92 \div 43.89 = \text{Oxygen } 72.73 \end{array}\right\} = 100 \text{ Carbonic Acid } (CO_2).$$

CARBONATE OF LIME.

$$\left.\begin{array}{l} \text{Lime } 55.86 \\ \text{Carbonic Acid } 43.89 \end{array}\right\} = 99.75.$$

$$\left.\begin{array}{l} 55.86 \div 99.75 = \text{Lime } 56 \\ 43.89 \div 99.75 = \text{Carbonic Acid } 44 \end{array}\right\} = 100 \text{ Carbonate of Lime } (CaO, CO_2).$$

SILICATE OF MAGNESIA.

$$\left.\begin{array}{l} \text{Magnesium } 23.9 \\ \text{Oxygen } 15.96 \end{array}\right\} = 39.86 \text{ Magnesia (MgO).}$$

$$\left.\begin{array}{l} 1 \text{ Silica } 59.96 \\ 2 \text{ Magnesia } (39.86 \times 2)\ 79.72 \end{array}\right\} = 139.68$$

$$\left.\begin{array}{l} 59.96 \div 139.68 = \text{Silica } 42.92 \\ 79.72 \div 139.68 = \text{Magnesia } 57.08 \end{array}\right\} = \text{Silicate of Magnesia } (2MgO. SiO_2).$$

Among the manufacturers of artificial cements during the past twenty years or so there has been a constantly growing ambition to increase the number of pounds of tensile strain their cement will

sustain, expecting thereby to improve the quality of their respective brands.

Goaded on by the universal preference for the brands showing the highest tests, they are striving by every means at their command to attain still higher results.

Many experiments were tried by adding foreign substances in varying percentages, among which may be mentioned sulphate of lime, which still obtains among nearly all the producers of Portland cement.

It is not denied by the manufacturers that by its use much higher short time tests are possible, and they justify its use by their assurance to the public that they do not use too much of it, thereby admitting its harmful character, which is so great that the German society of Portland cement manufacturers publicly advertise that the members of that society are not permitted to use more than three per cent. of this material in their cements.

No one will claim that a mixture of sulphate of lime in a cement is beneficial; on the contrary, it is well known to be harmful, and that a cement is better without it, even though it may not test so high by a few pounds in one-day or seven-day tests.

Its use simply illustrates the unreasoning desire to reach a little higher mark in testing.

Several years ago it was discovered that an addition of lime beyond its equivalent of silica would permit of a higher heat in calcination, which in turn gave a cement the quality of sustaining higher short time tests; and the manufacturers were not slow in availing themselves of this apparent advantage.

And thus the proportion of lime has been gradually increased until to-day there will be found in all brands of Portland cement, as has already been stated, from 2.7 to to 3.2 of lime to 1 of silica.

Although it was learned that by increasing the proportion of lime higher short time testing results followed, yet it became evident that such a cement must necessarily contain a large proportion of free lime, which was not considered a desirable result; and to overcome this unpleasant difficulty, some of the leading authorities asserted that the excess of lime was taken up and combined with the alumina, forming aluminate of lime, as shown in the tables quoted from Professor De Smedt, who, it will be observed, gives the combining proportions as silica 34.88 and lime 65.12, the ratio being silica 1, lime 1.86, and the ratio of alumina 1 and lime 2, to form aluminate of lime.

But as the percentage of lime has been gradually increased, it has been found necessary to establish a new ratio as between the silica and lime, the German authorities taking the lead in this new departure; and it is now gravely asserted that 1 molecule of silica combines with 3 molecules of lime, making the ratio 1 of the former to 2.79 of the latter.

As the modern Portland contains from 2.80 to 3.25 of lime to 1 of silica, the lime, which is in excess of the new ratio, is conveniently taken up by the alumina, forming aluminate of lime.

Thus for the present, at least, the authorities on Portland cement seem to have the ratio satisfactorily adjusted.

It is probable, however, that some way would be found to show conclusively that 1 part of silica combined with 4 or more parts of lime, should some genius discover a way to produce higher testing results by such a manipulation of proportions.

To show the tendency toward increasing the proportion of lime, which is done solely for the purpose of gaining higher short time tests, it is only necessary to take as an illustration the analysis of one of the foremost brands of English Portland cements; a cement which, twenty years or so ago, commanded the largest sale, and the highest price of any cement in the American markets.

The analysis was carefully conducted by the painstaking and conscientious chemist, Prof. E. T. Cox, while he was State geologist of Indiana.

The constituent parts of this cement, after discarding the non-essentials, will be found in column No. 1 of the following table, and the percentage of silicates appears in the succeeding columns.

No.	1		2		3		4		5		6		7
Silica .	30.89	—	1.65	=	29.24	—	17.44	=	11.80	—	11.57	=	00.23
Alumina	10.82	—	0.94	=	9.88	—	9.88	=	0.00	—	0.00	=	0.00
Lime .	57.19	—	3.08	=	54.11	—	32.52	=	21.59	—	21.59	=	00.00
Magnesia	1.10	—	1.10	=	0.00	—	0.00	=	0.00	—	0.00	=	0.00
Totals	100.00		6.77				59.84				33.16		00.23

Silicate of lime, magnesia, and alumina	6.77
Silicate of lime and alumina	59.84
Silicate of lime	33.16
Total silicates	99.77
Uncombined silica	00.23
Total	100.00

(To be continued.)

FROM OTHER COLUMNS.

WHAT CAN BE DONE WITH A BARREL OF PORTLAND CEMENT.

WHEN USED WITH 1 BARREL OF SAND.

68 sq. ft. 1 in. thick.
102 sq. ft. ¾ in. thick.
136 sq. ft. ½ in. thick.

WHEN USED WITH 2 BARRELS OF SAND.

99 sq. ft. 1 in. thick.
148½ sq. ft. ¾ in. thick.
198 sq. ft. ¼ in. thick.

WHEN USED WITH 3 BARRELS OF SAND.

130 sq. ft. 1 in. thick.
195 sq. ft. ¾ in. thick.
260 sq. ft. ¼ in. thick.

—*Paving and Municipal Engineering.*

THE term "hydraulic," as applied to mortars and cements, means that such masses continue to harden under water after they have set. Their "setting" may require half an hour, several hours, or even a whole day, according to the nature of the compositions, but the hardening under water is apt to continue with all of them for years. Hydraulic mortars are mixtures, the essential constituents of which are lime, siliceous substances on which dissolving lime can react chemically, and water; and hydraulic cements are either natural or artificial compounds of siliceous substances and lime, which have been burned to the sintering point, and which are used without admixture of lime. The setting of hydraulic mortars is due to incipient reactions that take place between dissolving lime and soluble siliceous matter. Though the quantity of the new matter that is formed by such reactions is at first of rather infinitesimal proportions, it is capable of bonding the mass in which it forms. When such masses are allowed to dry completely, then they do not become much harder — and sometimes not as hard — as ordinary air mortars. Hence it is said that hydraulic mortars *set* rather indifferently. Hydraulic cements set very energetically, because their particles — or at least a great portion of them — *hydrate* when they come in contact with water. Their setting may — in that respect — be compared with that of plaster-of-Paris, but with just this difference: the particles of a mass of plaster-of-Paris all hydrate inside of a few minutes and increase in volume while they are hydrating; hence, their cohesive attraction becomes partly neutralized by their expansion; the cement particles, on the other hand, do not expand sensibly, and hydrate gradually, not completely at once nor all at the same time; hence, it may be said that their mass solidifies actually on account of the cohesive attraction of its hydrating particles. That this action continues, long after the mass has set, is evident from the fact that hydraulic cements take up over three times as much water, within three days after having set, than they combine with while they are setting. — *A. D. Elbers, in Engineering and Mining Journal.*

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

FORMAL ESTIMATES.

PROBABLY the most important step in building operations affecting the relation between the architect and contractor is that of obtaining formal estimates or bids for proposed work. Most of the responsibility at this point rests with the architect, and if the drawings and specifications he presents for figuring are clear and complete, the execution of the work after the contract has been awarded should, so far as he is concerned, present comparatively few difficulties. And it is safe to say, on the other hand, that many of the annoyances and misunderstandings for which the architect can be held responsible, which so often arise in building operation, can be traced back, directly or indirectly, to the time when the work was figured. The obligations of the architect at this point are clearly set forth in recommendations of the Boston Society of Architects in regard to the practise in obtaining estimates from contractors. And they are here given in full.

1. Drawings, when offered for final or competitive estimates, should be sufficient in number and character to represent the proposed works clearly; should be at a scale of not less than one eighth of an inch to the foot, and be rendered in ink or some permanent process.

2. Proper details should be furnished for work that is not otherwise sufficiently described for estimate.

3. Specifications should be in ink. They should be definite where not sufficiently defined and explained by drawings, and every distinctive class of work to be included in contract should be mentioned and placed under its appropriate heading.

4. Contractors should be notified, at time of estimate, if they are to be restricted in the employment of their sub-contractors.

5. Sub-bids received by architects should be held as confidential communications until all the estimates in a given class of work have been submitted.

The principal contractor should add to his bids all these sub-estimates while in the architect's office, and should sign a tender in which the names of all of these above-mentioned sub-contractors should be enumerated.

6. A sub-contractor should not (without his free consent) be placed under a general contractor, and no general contractor should be compelled to accept (without his free consent) the estimate of any sub-contractor.

7. Should a contractor decline to assume in his contract the estimate for any work not included in his original estimate, he should not thereby be denied the contract upon the portions of the work covered by his original estimate.

8. Estimates should not be binding more than thirty days after they are received.

9. Unless previous notification has been given to the contrary in the specification or otherwise, the lowest invited bidder is entitled to the contract. If radical changes are made, the whole competition should be reopened.

10. After bids have been received, and before the award, bidders should not be allowed to amend their estimates.

It is important for the architect, while the estimates are being made, to scrupulously guard the interests of the different parties concerned, particularly those of the sub-contractors, whose figures, from force of circumstances, must be handled more or less openly, and are, consequently, more from thoughtlessness than any other reason, often left where they can be seen by competitors in the same class. Some contractors have a way after the bids have been opened but before the work has been awarded, particularly if they have cause to think their bid is not the lowest, of submitting amended and lower estimates, based upon the assumption that they have found a mistake in figures or discovered some way in which a considerable saving can be made. Such proposals should, under no consideration, be entertained, and any architect who considers them is sure to forfeit the respect of the bidders. There has been a practise among some architects of calling for a large number of alternative estimates upon a given piece of work. While this is justifiable under certain conditions, it always lays the architect open to the charge, whether well founded or not, that it is done to allow for trading or giving the work to a certain favored contractor, and in the best practise the number of alternative estimates are very limited and confined to important items. Ordinary alternatives as well as minor changes should be adjusted with the lowest bidder, and if his figures appear to be unfair, the matter can be settled by arbitration.

It is well here to call attention to the fact that much of the difficulty in properly adjusting the value of extra work or work omitted comes from the fact that contractors often figure work at cost, or with only a narrow margin of profit, and then depend for their profit on what can be made on "extras." This practise always produces most disagreeable results, and usually a running fight between the architect and contractor. There is no surer way to put an end to this undesirable state of things than for the architect to have the plans so well matured and the specifications so comprehensive at the time the work is figured that the contractor will be obliged to make his profit in a legitimate way or not at all.

It is well for the architect to bear in mind, when he offers plans and specifications for estimating, they will be looked at by a new set of men, and from a different point of view; he should, therefore, be willing to answer any fair questions which may be asked, and to furnish such information as may be necessary to explain his meaning. All the different parties who are figuring the work should be given the benefit of all such knowledge as affects their interest, and the best way to accomplish this is to keep a memorandum of the various points as they are raised, and before the estimates are handed in to send it to all the competitors. There is no better way in which the architect can win the respect of those who do work under his direction than to be absolutely fair and above board in handling estimates; and if he pursues such a course he will always find, if he deals with those whose intentions are right, that in a great measure so far as he trusts others he will be trusted himself.

(*To be continued.*)

MANTELS.

THE building of masonry mantels, whether of bricks, terra-cotta, or stone, has become almost an art by itself. The days when any bricklayer who could build a chimney was considered competent to build the fireplace are past.

Material has been multiplied and elaborated; bricks have been molded and carved; richly modeled terra-cotta and faience, carved stone and marble, are now extensively employed to make the mantel and fireplace an object of interest and of art, and a specially trained mason must be called upon to build it.

Unless specially trained to the delicate trade of building mantels, he will find his task quite a difficult one, even though he is a very efficient workman on outside brickwork. Sometimes a mason, however, is required to lay up mantels without the preliminary apprenticeship on mantel work. His experience on front brick-laying will of course be of immense assistance to him. The necessity of carefully laying out his work before building the mantel will be new to him.

The positive need of following a drawing exactly and intelligently will, perhaps, be the most difficult for him to realize. Among

our workmen there is a feeling sometimes shown that they deem themselves competent to do anything that is at all related to their trade. It is no discredit to a mason to state frankly that he has had little experience in this kind of work, but will do his best; such an admission will show his honesty, and if he display intelligence and care, he will find that he will receive patient assistance, and if he does not understand a drawing perfectly, he should have it explained to him. He will not only confer a favor on the architect, but will also advance himself in his new vocation, and, perhaps, save some expense and irritation.

It is dangerous and unsatisfactory when the unexperienced and thoughtless workman undertakes a delicate piece of work without appreciation of the needed carefulness, and with a feeling that he can bluff it through. It sometimes makes no end of trouble, especially in mantel work, where a botched job looks so evidently bad, and the ornamental parts, perhaps, cannot be replaced without long delays. The workman must respect his work, and feel that it is worthy of his best thought and most careful handling. The feeling with us that the first and all-important consideration is to get through with a piece of work as quickly as possible, get it finished and out of the way; the feeling of being hurried is injurious to the result unless a man is thoroughly experienced in his special line,— and, if so, he will probably be able to turn work off quickly. This constant pushing the workman must abide as a necessary evil; these are hurrying days and things must be done quickly. But the workman must bear in mind, also, that the real issue and the one most vital to himself and to all others concerned is that the work shall be done right and well. Haste will certainly not count to his credit if, when finished, his work is found to have been poorly done or mistakes made. Let each man be a law to himself, let his precept be, "Whatever I do shall be well done." This will give him a record, and with this a foundation principle, speed will come in good time, and the workman will be dubbed reliable and sure, and will in the rush of life naturally rise above his fellows.

BY PERMISSION OF THE PHILADELPHIA AND BOSTON FACE BRICK COMPANY.

Most men are desirous of improving their conditions in life, and the learning of a special line in a trade is one of the methods of improvement. There are really very few masons in the country who are qualified to lay up an elaborate brick mantel; and these are rapidly coming into use. Some are very ornate in design, requiring considerable skill to build, even after careful drawings. It really is a special trade, requiring very intelligent workmanship and careful calculation.

The architect finds the heedlessness of the workman one of his most trying conditions in erecting a building. A first-class builder will employ only competent workmen, and the majority, by taking an interest and pride in the work can be competent. It is this quality which causes a man to excel in any branch he may undertake in life. Some have it naturally, and others must constantly hold themselves up to a standard by vigilant watchfulness of self, if they wish to rise above the level of a laborer's station.

After a mason has become proficient in laying up a highly finished pressed brick front with one-eighth inch joints and carefully ground flat arches, he has had a good apprenticeship as an introduction to mantel work. Here he will find many complications arise unknown to external architecture, conditions which require his best judgment. He must know when he can settle a questionable point himself, and when it is wiser to appeal to a higher authority. In many cases he must be the final tribunal himself, and must wrestle alone with his drawing and his bricks. This element of judgment is a very important factor in mantel work, and as there is no rule of service to the mason, it must be inborn or cultivated by constant exercise and in all humility. There is one admonition, however, which the mason would do well to heed. The drawing for the mantel and fireplace will probably be quite right, and his first duty is to study it carefully and to follow it closely,— exactly, unless he discovers that its carrying out is impracticable. He must never tamper with a design with the view of improving it. This is a very delicate point, and the mason would do well to suppress his afflicted sensibility for art and follow the design precisely as indicated in the drawing. Suggestions of this nature, although given with best intentions, are seldom well received.

Before laying up any part of the mantel, the mason should place on the floor, in the relative position they will occupy in the mantel, all of the ornamental parts, and ascertain if all are on hand, and all are in a whole condition. This will also assist him in a translation of the drawing, and he may discover any mistake and be better able to rectify it before he progresses too far with his mantel.

Certain brick mantel concerns are careful to make a mantel fit the place for which it is intended and have all the ornaments space out correctly, and with such the mason will have no trouble. There are, unfortunately, other mantel firms who are not so exact, trusting to the mason to cut the ornaments and fit many parts of the mantel in place. This, of course, is unsatisfactory and will bring brick mantels into discredit. If the mason would complain of this state of things, mantel building would be much advanced, and the backward companies would soon be compelled to follow the leaders, and carefully fit their work before it leaves the yard.

Some knowledge of ornament is necessary to the mantel mason. He should know when his ornament is continuous and complete. He must know how to join the egg and dart, or the pearl and reel, to have them correct and architectural; and as he can hardly be expected to know this by instinct, he should make himself familiar with the usual forms employed in architectural ornamentation. The more intelligent and apt he becomes in the knowledge of architectural forms, the more able assistant will he be in putting into material existence a cherished design,— and the mason should believe that every design is a cherished one, no matter how simple or how bad it may seem to him. He should know all the arts of bringing the good points out of his material, for it may even be in his power to save a mediocre design by exquisite workmanship.

The color of the mortar which will affect the appearance of his work may be left to him. A few suggestions in the color of mortar may not be out of place here.

Lime mortar appears unpleasantly white when used with a dark-colored brick. It is desirable to add a little cement, which not only strengthens the mortar, but also grays it slightly. If a white or creamy brick is used, the pure lime mortar would lighten the general tone of the mantel, but is rather trying to the delicate tone of the light bricks; and if they run unevenly in color, it is better to add the cement, as it will give the work more character. A little red coloring in the lime mortar will give a pinkish flush over the work.

Faience and tile mantels should be laid with the finest joints possible, and pointed with Keene's cement, to expose a hard, white surface least susceptible to soil. The coloring of the mantel joints influences the tone of the mantel greatly, and may assist to harmonize the brickwork with the decorative scheme of the work with which it is placed.

A. MASON.

THIS department is always open to our subscribers for the discussion of any subject that may be of interest to the mason.

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

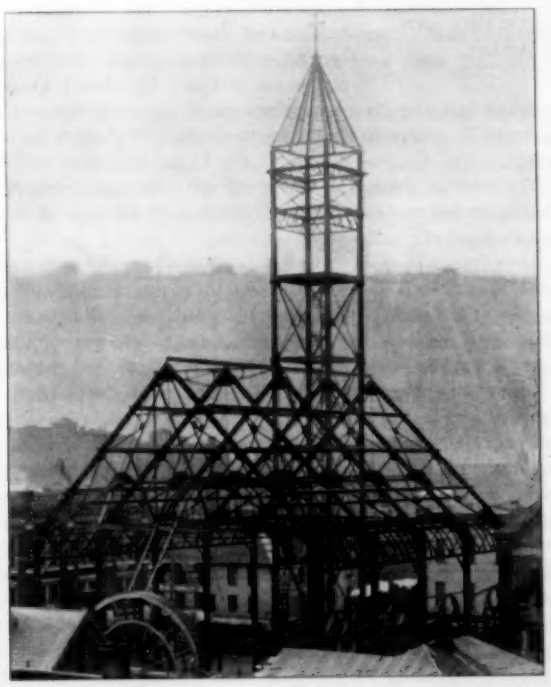
TERRA-COTTA FIGURE IN ST. JOHN'S CHURCH.

WE publish with this issue a number of cuts, illustrating the construction and the details of the Church of St. Johns, at Johnstown, Penn., and we feel that they warrant a little more than a passing notice, as affording an example of a church edifice, constructed almost entirely of brick, terra-cotta, and tile. In fact, these materials are used exclusively for all the exterior, with the single exception of the front doors. The construction of the church is entirely on the skeleton system, another innovation on the ordinary plan. The framework starts from the foundations with heavy Z-bar columns, and is carried across the church with steel truss construction, and up into the towers with lattice tracings. Although the skeleton is of steel, the only difference which it makes in the construction is in the thickness of walls and consequent cost. The outer walls are from 18 to 24 ins. thick. The smaller tower is roofed with a very clever adaptation of the form of 10 in. tile usually adopted for floor construction, the tile in this case of course being made to order, with a specially shaped shell pattern on the outside. The main tower is capped by a pyramidal roof covered with terra-cotta tiles. Constructively this design offers a great deal of interest. It is an honest attempt to use a consistent brick and terra-cotta treatment throughout, and, as far as we can recollect at this moment, is the only building of its kind in existence. The floor construction is entirely of steel and brick, terra-cotta, or concrete, being practically fire-proof throughout. All of the exterior details are executed in terra-cotta, including the frieze of figures around the top of the larger tower, and the crowning statues of the gables, which are modeled and burnt in a single piece. The cost of the completed structure was about $80,000. The terra-cotta was executed by the

TERRA-COTTA FRIEZE, MAIN TOWER, ST. JOHN'S CHURCH.

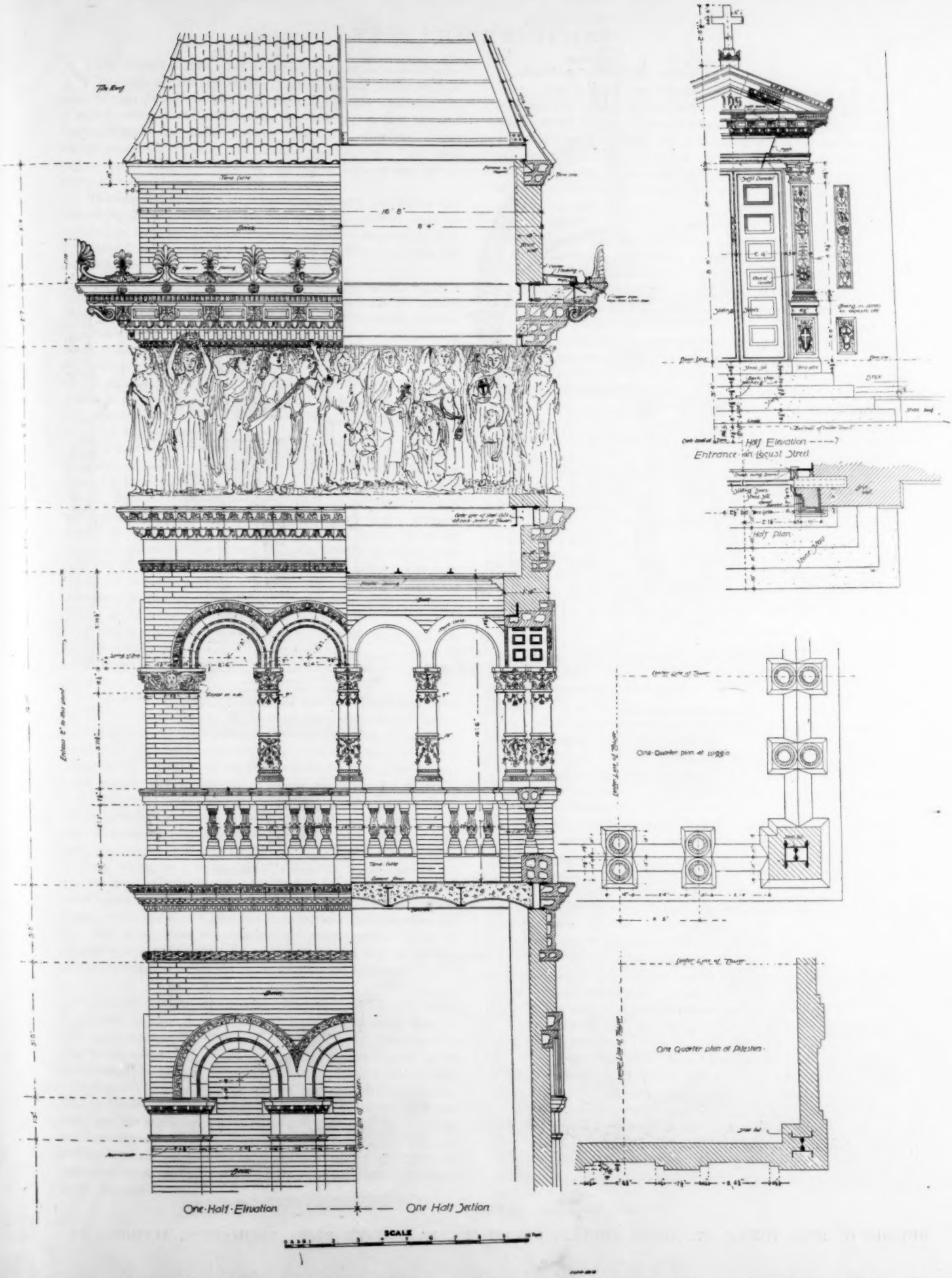
Standard Terra-Cotta Company, of Perth Amboy, N. J., from the designs of Beezer Bros., Altoona, Pa., the architects of the church.

Scale drawings of the tower details are shown on pages 89 and 90.

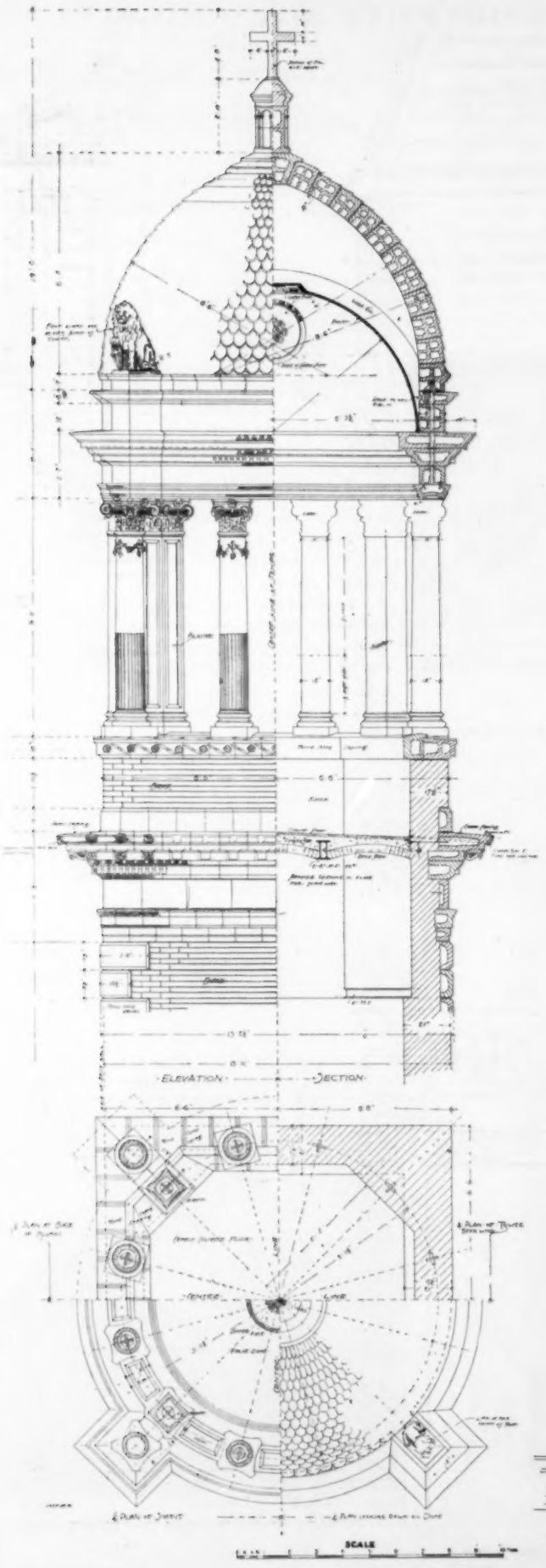


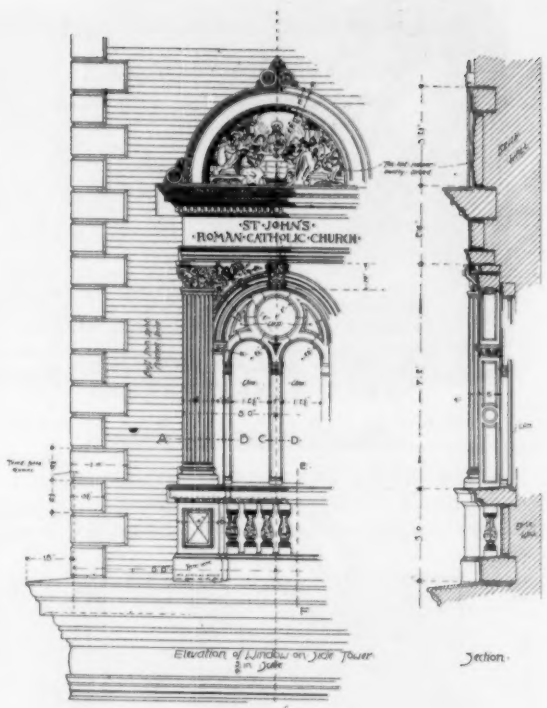
SKELETON STEEL FRAME, ST. JOHN'S CHURCH, JOHNSTOWN, PA.

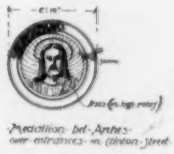
ST. JOHN'S CHURCH, JOHNSTOWN, PA.,
Beezer Bros., Architect.

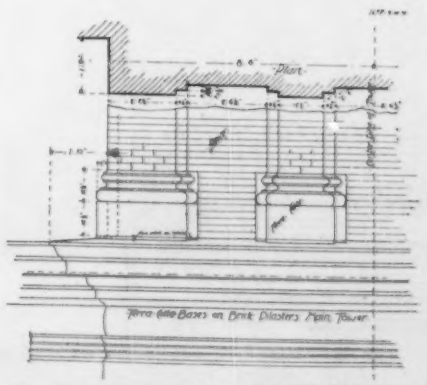


DETAILS OF MAIN TOWER, ST. JOHN'S CHURCH, JOHNSTOWN, PA. BEEZER BROS., ARCHITECTS, ALTOONA, PA.









DETAILS OF SIDE TOWER, ST. JOHN'S CHURCH, JOHNSTOWN, PA. BEEZER BROS., ARCHITECTS, ALTOONA, PA.

NEW YORK.— The most important piece of news in the discussion of buildings in New York is that the legislature has failed to pass the bill to limit the height of business buildings. It is said by some of the writers upon the daily papers that this is a final settlement; that, before another session can occur and a new bill be presented, so many tall business buildings will have been begun, that to restrict others from building as high as they please would be a gross injustice.

The question of justice or injustice is not what determines the acts of legislators. However, the bill which has recently been defeated must have had powerful interests behind it, so powerful that it is, indeed, improbable that any weightier backing for a new bill can easily be found.

Certainly owners seem disposed to avail themselves of their now undisputed liberty to build Babel towers *usque ad cælum*. Although architects share the general dulness of business, yet there is enough doing here and there to raise cages of steel, covered, wholly or partly, with their brick casings all along the line of Broadway and upon other main thoroughfares.

In spite of the serious objections that may be fairly urged against such structures, the one preponderant reason for their existence is absurd and impossible size, to which the modern aggregation called a city is fast extending.

The time was, and not so very long ago either, when a city was a circumscribed locality, with clear boundaries and sharp definition between it and the outlying country, even after the days of walls had passed. Paris of the Revolution had but half a million people, and until recently only London could have been described as a *province couvert de maisons*. But now every city that aspires to be called great is of unheard-of dimensions. The really built up part of New York and the adjacent Brooklyn is ten miles long and seven or eight broad. It is easily possible in the city of New York proper, on Manhattan Island, to travel fifteen or twenty miles daily, simply running about doing necessary business errands.

There is a limit to this sort of thing. If men live in cities for the convenience and economy of being near together, the reason for the existence of cities vanishes if their inhabitants are not near together.

That is why the high building has taken the hold that it has. For my part, miserable and moribund as the whole system seems to me, I should like to see it pushed to its logical extreme and see what would come of it before commercialism perishes, as one pushes their mathematical formulas to an impossibility of a zero or infinity before leaving the investigation. I should like to see the restriction on the height of dwelling-houses which does exist finally removed, and try whether immensely high apartment houses could not be made as comparatively comfortable and luxurious as office buildings have been proved to be. It is not an entirely delightful thing sitting, as I am sitting, in a seventh-story room, with a fine view of the seventh story of another just such building. It would be much better worth one's while to live if life could be in a distant country studio, as was the wise Richardson's, with leaves, and blossoms, and sky. But if we must join ourselves into closest contact, driven by self-destructive social forces, let us make our crowding as comfortable as we can, and abjure the trolley in favor of the elevator.

CHICAGO.— The recent exciting Republican State Convention, held at Springfield, Ill., was incidentally interesting from the fact that it occurred in the "Dome Building," which is the beautiful glass dome, designed by Jenney & Mundie, as the chief feature of the Horticultural Building at the World's Fair. After the fair the lofty shell of steel and glass was removed and erected at the State capital. With the addition of corner pavilions, forming a suitable architectural base, the exposition greenhouse was transformed into a permanent exposition building. Those who visited the World's Fair and saw the Horticultural Building, with its big dome, will be surprised to know that ten or twelve thousand people were gathered in convention under that same dome.

Another building of political association is the Chicago Coliseum. This is where the Democratic National Convention is to be held, and it is noteworthy, not only for that and for the catastrophe that occurred during its first construction last year, when the steel arch roof trusses collapsed into a complete wreck, but because just now there is being installed a heating plant of unusual general interest. The general arrangement can easily be imagined by thinking of the Manufactures Building at the World's Fair. The building is 700 ft. long and 300 ft. wide. The entire heating plant (except boilers which are outside at a distance) is located in one corner under the gallery. Fresh air is taken in through zigzag screens, and is then washed in a spray which requires 1,600 gallons of water per minute. Four 12 ft. Sturtevant fans, working in pairs, draw the air through steam coils, and force it through two great galvanized iron ducts, running each way under the galleries. These two trunk mains at the beginning are each 3 ft. deep by 20 ft. wide, and reduce gradually as various branches shoot a part of the warm air into space under the lofty roof, as well as under and above the gallery floor. There are no vents provided aside from cracks around windows and doors, and no air is reheated, but is taken constantly from out of doors. The contents of the building are 12,000,000 cu. ft., and the fans are capable of supplying that amount of fresh air every thirty minutes. There are no steam pipes or other radiation in the building except 60,000 sq. ft. in the corner where the fans are located. The contract for the installation of this heating plant, which was designed by the Chicago house of the Sturtevant Company, amounted to $36,000.

Those in a position to know assert that this is the dullest building season in Chicago for four years past. Building news have few important items in them. There is one, however, that *is* important. It is a great banking institution, only two stories high, to be located in the heart of the city. If present ideas materialize, this home for the Illinois Trust and Savings Bank will be a notable one.

Several well-known firms of architects in competition are now working on their respective solutions of the problem given them, which involves a large banking-room, covered with a dome. Surrounding this central banking-room are two stories of offices. The exterior is to be classic in treatment, and it is to be hoped that the result will be as much a matter of pride to Chicago as was the Art Building among the White City group.

A matter of lively discussion just now among architects is the "Code of Practise" just issued by the "Chicago Masons' and Builders' Association." Some of the salient points in this set of rules are as follows: —

Members are to buy materials from those dealers only who bind themselves to charge others ten per cent. higher than members of the association.

Demands made by the plans, and not referred to in the specifications, shall not be considered in the proposals.

Specifications shall state the day and hour when proposals are to be opened.

Bids must be opened and listed publicly, and the contract must be let to the lowest invited bidder.

Masons must not sub-let any of their work except for setting stone, tile, and terra-cotta.

Masons must not, in general, take any sub-contracts.

The association has a rule forbidding a member having partnership with a carpenter.

One rule in the "code" lays down the law that the particular form of contract adopted by the association is the only form of contract a member is allowed to execute for mason work.

The aim of the "code" is commendable, and many of the provisions are good. Doubtless, some of the most arbitrary rules had their reason in abuses indulged by dishonest architects and owners, whose moral sense is on a low plane, but the dictatorial tone and arbitrariness of some of the rules will, no doubt, be strongly resented.

PHILADELPHIA.—There is a movement on foot to prevent the continued erection of high buildings in and surrounding City Hall Square; at present it is in the shape of a petition to councils to condemn the properties to the northwest of the square, remove them and throw the block open to the public as a plaza; the scheme is in the hands of some of the most influential citizens, and is likely to receive favorable consideration; it is rumored that if this plan is approved by councils, there will be still another brought forth which will further improve the surroundings of the Hall.

The Board of City Trusts has abandoned the idea of tearing down the buildings covering the block between 11th and 12th Streets, and Chestnut and Girard Streets, and erecting thereon an immense building, as mentioned in our letter of last month; there will be a thirteen-story building erected upon the corner of 12th and Girard Streets, for which bids are now being asked: it will be of stone, brick, and terra-cotta, and be one of the most beautiful of the many office buildings in the city; the architect is Mr. Jas. H. Windrim.

Horticultural Hall, on South Broad Street, is fast nearing completion, and is having the finishing touches put upon the exterior; these are in the form of color decorations in the frieze and under the overhanging roof; from present appearances, they will greatly add to the beauty of the building, and should be a stimulus in the direction of more color treatment in our buildings; Messrs. Frank Miles Day & Bro., who are the architects, have, within the last few years, designed and executed several buildings in which similar color decorations have been prominent features; they are quite successful and universally liked.

A large Catholic Protectory is to be built this summer at Fatland, near Phœnixville, Penn., bids for which were recently asked in this city. It will be very large and extensive, embracing reservoir, refectories, workshops, etc.; the walls will all be faced with Pompeian bricks; Wilson Bros. are the architects.

ST. LOUIS. — The advance of spring offers no encouragement to the builder. What little hope some had of times being better has been dissipated, and every one has decided to make the best of it.

This city felt the panic of 1892 less, perhaps, than any other of the large cities, but we seem to have our turn now. There is, apparently, no good reason for this, as the new buildings and residences that have been finished lately do not stand vacant long.

Owing to the letting of some of the most important contracts to outside parties, the leading master builders have perfected an organization, hoping to advance the building interests in the city and protect themselves. It has a large membership, and its offices are filled by the most prominent builders of the city. Elegant quarters have been fitted up in the Turner Building, and were opened a few days ago with a banquet.

During the last few years almost the entire population of St. Louis have changed their residence, and the aristocratic neighborhoods of five or ten years ago have become business or manufacturing districts, the former occupants having gone into the suburbs, laid out and built beautiful parks, fine boulevards, and grand homes.

These places are of all grades, and so classified that even the most humble mechanic can find as desirable a home as the most aristocratic, although it may not be surrounded with all the elegance.

Large tracts, that five years ago were truck farms, dairies, etc., are now covered with residences, and the completion of the electric lines to Kirkwood, Clayton, and other suburban and county towns has opened up much new territory which will soon be covered with homes.

Doubtless there is no building in this city in which more interest is centered at present than the Auditorium, in which is to be held one of the great conventions next June, to place in nomination a candidate for President. By the time this appears in print it will be receiving the finishing touches.

It makes no great pretensions to architectural beauty, but the simple tale it tells is in marked contrast to some of our more pretentious buildings.

The Fagin Building, which is known at home and abroad for its startling architecture, and in the designing of which the architect sought originality, giving much time to special study and travel, is about to be thoroughly renovated. The massive granite front will be replaced by one of brick and terra-cotta, and with the extensive alterations in its interior it will be practically a new building.

The Brown Shoe Company is building a seven-story factory, to cost $100,000 when completed. Only four stories and basement will be built this year, but the additional stories will be added next. It is to be thoroughly fitted with the most modern machinery as well as construction. All machinery will be run by direct electricity. F. C. Bonsack is the architect.

Mr. Isaac Taylor is preparing plans for a building to replace the old landmark on the corner of 5th and Pine Streets.

The Holland Building, which, after many vicissitudes, was at last put on the market, seems to have come to a standstill again. The purpose of the projectors was to put up a building, arranged for physicians, providing for their special needs in the arrangement of rooms and other conveniences, including a library.

The design is in the German Renaissance, twelve stories, with high roof, in which is arranged the assembly room for society meetings, etc.

It is to be of steel construction, with exterior of brick and terra-cotta. Wheeler & McClure are the architects.

PITTSBURG. — The prospects for a good building season in this city are very flattering. Several of our architects have under way good structures, and others are busily engaged in preparing sketches. Pittsburg building tradesmen will not participate in the movement for the adoption of an eight-hour day this year. They are interested in getting wages advances first, and will leave the former for next year's consideration. The painters' strike has been settled by compromise, the wages agreed upon are $2.75 per day. The plasterers have also won their strike, which was for $3.00 per day.

The Carnegie Steel Company has been awarded the contract for the structural iron work for the Allegheny Post Office Building, with the exception of the dome, which will likely be of aluminum, furnished by a Chicago firm.

The plans of the Civic Club for the erection of free bath-houses are assuming tangible shape.

The sixth ward school board of Allegheny contemplates the erection of a new structure to cost $100,000.

The third ward is also considering the erection of one to cost $50,000.

Local architects have submitted plans for the Apollo school; to be of brick and stone.

The building committee of the Allegheny Theological Seminary has decided to erect a magnificent U. P. Seminary on the site of the present structure, to cost $125,000.

The Eighth U. P. Church of Allegheny propose to erect a new edifice on Perrysville Avenue, to be built of buff brick and stone, and to cost $35,000.

The Watson Memorial Church is having plans made for its new house of worship to be built at the entrance to Riverside Park.

Andrew Carnegie has purchased ground at Duquesne, upon which he will erect a library and gymnasium, to be of brick and stone, to cost $150,000.

The Westinghouse Library at Wilmerding, which was recently destroyed by fire, will be rebuilt at once, to cost $65,000.

The Syria Temple, Ancient Arabic Order Nobles of the Mystic Shrine, will erect a temple, corner Forbes and Stevenson Streets.

Architect Henry Mendall has prepared plans for an institution to be known as the Evangelical Lutheran Young People's Orphan Home, to be erected on Spring Hill, Allegheny, of brick, three stories, and to cost $20,000.

Architect E. E. Miller has prepared plans for a church for the U. P. Church of Sewickley.

Architect F. C. Sauer has prepared plans for a brick and stone church for the Immaculate R. C. Church, of Connellsville.

Architects E. J. Carlisle & Co. are receiving bids for the erection of the Hazelwood Presbyterian church; also for the school building at Duquesne.

Architect F. H. DeArment has prepared plans for a bank building for the First National Bank of Sistersville, West Va.

The First Presbyterian Church of Braddock have purchased a site on which they intend to erect a $30,000 church building.

DETROIT. — Architects Mortimer L. Smith & Son are letting contracts for the business block to be erected for the Eralsey Ferguson estate, illustration of which is presented herewith. It will front 63 ft. on Woodward Avenue, and extend 100 ft. down John Street. It will be of steel frame construction, with hollow tile arches for fire-proofing. The first and second stories will be of light-colored sandstone, and the remainder of the front brown pressed brick with terra-cotta trimmings. The roof will be of asphalt. The probable cost, $100,000. The work of construction will be commenced at once and pushed vigorously.

Architect Henry Engelbert, of this city, has plans for a church and convent for the Order of the Serites, to be built on Jackson

NEW BUILDING FOR THE E. FERGUSON ESTATE. WOODWARD AVE. MORTIMER L. SMITH & SON. ARCH'TS.

Boulevard, Chicago. It will be 216 by 132 ft., constructed of stone, pressed brick, and marble. Estimate of cost, $120,000.

Architects Rogers & McFarlane have plans for an elegant colonial residence for Mrs. John Owen, to be erected on Jefferson Avenue, built of pressed brick, terra-cotta trimmings. Same architects have plans for a three-story block on Woodward Avenue, to be built of pressed brick with terra-cotta trimmings.

Architects Nettleton, Kahn & Trowbridge, who have just taken a handsome suite of offices in the new Union Trust Building, have plans for two four-story apartment houses, both to be built of pressed brick. Architects Baxter & Hill have plans for a terrace of eight three-story residences for John McDonald, to be located on southwest corner of Forest Avenue and St. Antoine Street, to be built of buff brick with sandstone trimmings.

Architects Malcomson & Higginbotham have plans for a brick and stone church for the Trumbull Avenue Presbyterian Society, to be built of brick and stone.

Architect Wm. S. Joy has plans for a $10,000 residence for Wm. A. King, Esq.; pressed brick and stone trimmings.

Architects Mason & Rice have plans for a pressed brick residence on Merrick Avenue, for Joseph M. Weiss.

MINNEAPOLIS. — Many of the schemes projected early in the year, and some a year or more ago, are now a certainty, active operations having begun in most instances. This has brought about a marked change for the better in building prospects for 1896, one of the results being that there are not enough mechanics available to do the suddenly increased volume of building that has been decided upon.

Work is being pushed on our immense new City Hall and Court House, and no doubt will be completed by the end of the year.

A chime of eleven bells has been placed in the tower of this building; the quality of their tones is giving entire satisfaction.

Among the more important items of improvements under way may be mentioned the following: seven-story factory building, 82 by 140 ft., corner First Avenue and 5th Street, C. B. Heffelfinger, architect, pressed brick front, mill construction, cost, $75,000. Three-story business building, 50 by 185 ft., at 3d Street and Fourth Avenue, for A. C. Godfrey, pressed brick fronts, cost, $20,000. Four-story cold storage warehouse for T. B. Walker, cost, $60,000. Orff & Joralemon were the successful architects in the competition for a county court house at Waseca, Minn. The building will be of pressed brick, and cost $45,000. Same architects have planned a school building for Stanley Hall School on Pleasant Avenue. The Board of Education has recommended another new school building in Hawthorne Park District, probable cost, $75,000. The Swedish Lutherans are taking steps towards the erection of a large hospital for their people. W. H. Hawes has plans for a Presbyterian church at Warsaw, Wis., to be built of pressed brick. E. P. Overmire has plans for a church for the Franklin Avenue M. E. Society, built of pressed brick with tile roof, cost, $50,000. W. C. Whitney has plans for a residence at Louisville, Ky., for S. A. Culbertson, pressed brick with terra-cotta trimmings and tile roof. Architect Jebson has plans for a residence for A. M. Smith on Nicollet Island, one half of which will be fire-proof, for library purposes.

The capitol commission has awarded the contract for foundations to Geo. J. Grant, of St. Paul, for $107,677; main walls are to be of granite, area walls and steps of local blue limestone, dome foundations of Kettle River sandstone. Work will begin at once.

PLATE ILLUSTRATIONS.

DORMITORY BUILDINGS AT THE UNIVERSITY OF PENNSYLVANIA, COPE & STEWARDSON, ARCHITECTS. PLATES 24, 25, 26, 27, 28, 29.

THE whole group of buildings, of which a large part is now under way, will cover a block of ground 320 ft. in width by 1,070 ft. in length. The eastern half of this block will be rectangular, while the western half forms a triangle, the base of which abuts on the eastern half, and one side of which is continuous with the side of the rectangle. The buildings will lie close to the street lines, and enclose a large quadrangle on the eastern half and a large triangle on the western half. Near the extreme western end — that is, near the apex of the triangle — the surrounding line of buildings is broken by a small court or quad, open on one side to the street.

The whole group will be enclosed by a high iron fence on the inner line of the sidewalk, and there will be but one entrance for regular use, where, as in English colleges, the porter can see every one who enters or leaves the dormitories.

The students' quarters consist of the usual blocks or staircases, each with its entrance on the inner enclosure. These blocks are separated by party walls, so that the whole system is in the nature of rows of houses. Each stairway gives access to the rooms for an

average of about six men on each floor. The system will include a large dining-hall and chapel. There will be studies and sleeping rooms for about one thousand students — and the dining-hall will seat about 650. The drawings published include only that part of the work surrounding the triangle, most of which is now under roof. The dining-hall will be the next part built, and the buildings surrounding the large quad, including the chapel, will follow.

The foundations are of stone on concrete footings — the walls above the ground line of brick, built with a middle air space.

The floors are of steel beams with terra-cotta flat arches. But the roof construction and fourth floor, which is in the roof, are of wood.

The brickwork is laid in Flemish bond, and the headers are vitrified more or less. The mortar is slightly darkened with "French gray," and the joints raked. The bricks are the darkest selection of the ordinary hard brick manufactured by Sayre & Fisher, Sayresville, N. J. The stretchers are dark red and brown, but the headers have little red in them. Some are almost slate color, with a slight mixture of deep yellow. Others have so much yellow mixed with blue as to produce a warm moss green. The result in coloring of the whole wall is very satisfactory.

The style, as will be recognized from the drawings, is "Jacobean."

A TERRA-COTTA STATUE.

ON the 22d of February last, there was presented to the city of Perth Amboy, N. J., by her Scandinavian-born citizens, a statue of George Washington, which had been executed in terra-cotta. The figure and base stands 17 ft. 2 ins. high, and is of a light gray or limestone color. We believe this to be the only monument

TERRA-COTTA STATUE OF GEORGE WASHINGTON.

made wholly of terra-cotta in the country, and it admirably demonstrates the possibilities of this material in a new field.

The modeling was done by Mr. N. N. Alling, of Perth Amboy, who is a graduate from the Royal Art Academy of Copenhagen. The execution of the whole design is the work of the New Jersey Terra-Cotta Company.

GROWING DEMAND FOR WHITE BRICKS IN LARGE CITIES.

EVEN to the casual observer it must be apparent that white bricks, as well as those of a light-gray color, are being more extensively used than ever before by the better class of architects throughout the country, in the more important class of buildings.

Of the larger structures that have recently been erected or begun in New York City, a surprisingly large number have exterior walls of these light-colored bricks. This fact is not altogether to be wondered at when the eminent qualifications of this material is considered. In the matter of durability, cost, and pleasing effect, certainly burnt clay will more than hold its own with any other building material; nor can it be said that the use of gray and white bricks is a passing fad; on the contrary, the very fact that architects are using them in buildings that must stand for years as monuments to their skill would disprove such a notion.

It may in truth be said that the tall structures that are being so rapidly reared upon our narrow city streets must of necessity be clothed with material so light in color as not to preclude from these man-made canons all semblance of light, but who will say that the broad avenues extending through the residence portion of our cities are not made more beautiful by the use of these lighter colors in brick for exteriors?

Apropos to this statement, it may be mentioned as a matter of interest, that during a recent visit at the office of the Sayre, Fisher Company, of New York, one of the largest and best-known front brick manufacturing concerns in the country, it was learned that they had recently closed the following contracts for their light-colored bricks, which are made from stiff mud: 1,500,000 white bricks to be used in two large hotels, New York City, for D. O. Mills, Esq., Ernest Flagg, architect.

Seven hundred thousand white bricks for the new Commercial Cable Building, Broad St., New York City, Harding & Gooch, architects.

Three hundred thousand white bricks for the new Bank of Commerce Building, Cedar and Nassau Sts., New York City, James B. Baker, architect.

Seven hundred and fifty thousand white bricks for the new Bowling Green Building, Broadway, New York City, W. & G. Audsley, architects.

The Messrs. Audsley, who practised architecture in England many years before coming to this country, may be said to be enthusiastic supporters of the use of brick in architecture, sharing in this respect the reputation of the late Mr. Street, with whom they had a most intimate acquaintance.

WATCH THIS COLUMN FOR POINTERS.

MESSRS. FISKE, HOMES & CO., Boston, are the New England agents for the Mannheimer Portland Cement, of which Morris Ebert, Philadelphia, is the sole importer and agent for the United States.

THE MANHATTAN CEMENT COMPANY, of New York, have moved to new and more commodious offices at 15 to 25 Whitehall Street, New York City.

THE NEW MORRISON-TRAMMELL BRICK COMPANY, at Rome, Ga., commenced to make brick on the 25th of April with a Chambers machine, recently erected.

THE SAYRE, FISHER COMPANY will supply one hundred and fifty thousand Roman sized mottled bricks for the Hotel Renaissance, 43d Street and Fifth Avenue, New York City, Howard & Cauldwell, architects.

E. P. LIPPINCOTT & CO., of Baltimore, are supplying buff brick for the residences of Mrs. Jenness Miller and Senator Sherman at Washington, D. C.; also the Riggs Insurance Building, for all of which T. F. Schneider is the architect.

THE FAWCETT VENTILATED FIRE-PROOF BUILDING COMPANY have had their system of fire-proofing specified in the Boys' High School Building at Philadelphia. This is one of the largest school buildings in the country.

THE SAYRE, FISHER COMPANY have orders to supply one hundred thousand enameled bricks and two hundred and fifty thousand buff bricks for the new Court House Building at Baltimore, Wyatt & Nolting, architects.

HON. JOHN W. BOOKWALTER will push the work of rebuilding the Lagonda House, Springfield, Ohio, which was recently destroyed by fire. It is his ambition to make it one of the finest buildings in the city. Powhatan cream-white bricks will be used in exterior walls.

THE PERTH AMBOY TERRA-COTTA COMPANY will supply the architectural terra-cotta for two warehouses north side of West 3d Street, between Wooster and Green Streets, New York City, Alfred Zucker, architect; Second Reform Church edifice, Reading, Penn., Geo. W. Beard, architect; the Triangle Building, Rochester, N. Y., J. Foster Warner, architect.

CELADON TERRA-COTTA COMPANY, Charles T. Harris, lessee, are supplying the roofing tile for the new Public Library Building, Kansas City, Mo., for which Smith & Hackney are the architects, A. Van Brunt, associate. Their standard 8 in. Conosera, vitrified red tile has been specified for the residence of A. Kaufmann, Esq., St. Louis, Mo., of which Link & Rosenheim are the architects.

THE PHILADELPHIA & BOSTON FACE BRICK COMPANY'S WORKS, at Boston, are being worked at their fullest capacity. This company makes all colors of plain and fancy brick. Henry W. Savage, Esq., is building on Addington Road, Brookline, Mass., a block of houses in which sixty thousand pressed gray-faced brick will be used; same are being furnished by the Philadelphia & Boston Face Brick Company.

THE PIONEER FIRE-PROOF CONSTRUCTION COMPANY, with headquarters in Chicago, have closed contracts for fire-proofing on the following buildings: Female Hospital and Illinois State Penitentiary, Joliet, Ill., J. H. Lawler, architect; barn for the Fred Miller Brewing Company, Milwaukee, Wis., Wolff & Nevins, architects; barn for the Joseph Schlitz Brewing Company, Milwaukee, Wis., Louis Lehle, architect.

THE STEELTON BRICK WORKS, at Steelton, Penn., destroyed by fire some weeks ago, has placed its order with Chambers Brothers Company, at Philadelphia, for new machinery, and an entire outfit of Chambers machinery will be installed as soon as possible. This company has consolidated the Zimmerman Brick Yards at Harrisburg, Penn., which were equipped with Chambers machinery last season.

THE NEW JERSEY TERRA-COTTA COMPANY is furnishing architectural terra-cotta for the new synagogue at New Haven, Conn., of which Brunner & Tryon are the architects; also for the residence for Spencer Aldrich, Esq., 72d Street and West End Avenue, New York City, G. I. Schellenger, architect. Same company will also furnish the terra-cotta for the large office building on Broadway, New York City, for Messrs. Weil & Mayer, for which Claverdon & Putzel are the architects.

THE NEW YORK ARCHITECTURAL TERRA-COTTA COMPANY has been exceptionally busy during the past winter and spring of present year. The work for the seventeen-story Astor Hotel, Fifth Avenue and 34th Street, New York City, on which it has been engaged is now well advanced, and the contracts which have been closed, or are in course of adjustment, promise an equally prosperous summer and fall. The prevailing colors this season are white, cream, buff, and gray, in the production of all of which this company has been eminently successful. The wonderful uniformity of its (limestone) gray has often been referred to by correspondents of THE BRICKBUILDER.

THE FAWCETT VENTILATED FIRE-PEOOF BUILDING COMPANY, of Philadelphia, closed the following contracts during the month of April: —

American Baptist Publishing Society Building, Lombard and Juniper Sts., Philadelphia, Penn.

Store Building, for Hull & Morton, Pittsfield, Mass.

The Roberts Warehouse, Boston, Mass.

Club House, for Philadelphia Base Ball Club, Philadelphia, Penn.

Physicians' & Dentists' Building, Philadelphia, Penn.

St. Francis Hospital, Pittsburgh, Penn.

THE EXCELSIOR TERRA-COTTA COMPANY, of New York, have closed the following contracts for architectural terra-cotta: New building for *Munsey's Magazine*, at New London, Conn., Wm. B. Tuthill, architect. Spingler Building, Union Square, New York City, Wm. H. Hume & Son, architects. Warehouse, Washington Place and Greene Street, New York City, Robert Maynicke, architect. Edison Building, Atlantic Avenue, Boston, Winslow & Wetherell, architects. Murray Hill Theater, Lexington Avenue and 42d Street, New York City, McElfatrick & Son, architects. Twenty-one story office building for the Commercial Cable Company, Broad Street, New York City, Harding & Gooch, architects. Hartford Life Insurance Building, Hartford, Conn., F. R. Comstock, architect. Building for the Lynn Gas & Electric Company, Lynn, Mass., J. T. Kelly, architect. Office building for the Mechanics' Bank, Court and Montague Streets, Brooklyn, N. Y., Geo. L. Morse, architect.

NEW TRADE LITERATURE.

THE up-to-date catalogue or trade pamphlet is one that contains a fund of information that is of general interest pertaining to the particular trade it represents. There can be no doubt that in the compiling of one of these trade publications every effort is made and no expense spared by the enterprising merchant, to place before his readers only such data as may be considered authentic, the result being that we frequently find them not only interesting, but valuable for reference. Especially is this true of the booklet just issued by Morris Ebert, Philadelphia, importer of the Mannheimer Portland Cement.

Among the many interesting features contained in this little volume may be mentioned that part which is devoted to rules and suggestions regarding the various uses of Portland cement, tables showing the relations between the Fahrenheit and Centigrade or Celsius thermometers, contents in gallons of each foot in depth of cisterns or wells, also other tables giving the metric system of weights and measures, and for converting of kilograms per square centimeter into pounds avoirdupois per square inch.

Copies sent on application to Morris Ebert, 302 Walnut St., Philadelphia, Penn.

ANOTHER valuable book for reference in the trade publication line is the catalogue of the Empire Fire-proofing Company of Pittsburgh and Chicago. This volume is liberally illustrated with the constructive details of their system for fire-proofing floors, partitions, ceilings, and columns, and contains, besides, much valuable information regarding the construction of same.

Terra-cotta wall and chimney copings, also fire-clay flue linings, are illustrated and described in the same manner. These, with illustrations of some of the more important buildings for which they have furnished fire-proofing, make a most attractive catalogue.

THE TIFFANY PRESSED BRICK COMPANY, of Chicago, have issued a neat little booklet brimful of information, put into concise form, regarding enameled bricks, of which they are large manufacturers.

Following we give some quotations which are of general interest: —

These bricks are made in English and American sizes, of all shades and various shapes, including Roman, and are guaranteed to be equal in quality to the best English, and superior to them in some respects.

SIZES OF OUR ENAMELED BRICK.

English, 9 by 3 by 4½ ins.
American, 8¼ by 2¼ by 4 ins.
Roman, 12 by 1½ by 4 ins.

REGULAR STOCK.

Stretchers, quoins, octagon, round end, splay, and soaps. Radius and special shapes made to order on reasonable notice. Our works being under cover, orders can be gotten out at any time. Full scale drawings required for special shapes.

COLORS.

White, ivory, cream, buff, brown, chocolate, blue, green, granite, etc.

Beautiful effects in fireplace, mantel, and chimney work may be produced with the various shapes and shades of our enameled goods and with the aid of the architects' working plan, the bricks can be set by any experienced mason.

We wish it to be specially noted that our bricks are NOT GLAZED but are THOROUGHLY ENAMELED, the enamel forming a complete and *inseparable* union with the bricks, which will stand for inside or outside work in any climate.

It should be noted that while 7½ brick of the ordinary (American) size are required per superficial foot of wall, only 5⅓ are needed in the English size, a difference of about 33⅓ per cent. in favor of the latter, which, with the saving in laying and materials, makes the larger brick cheaper to the contractor, at, say, $90 per M. than the smaller brick at $70 per M.

WASHINGTON MONUMENT.

As the towering height of the **Washington Monument** exceeds that of all other similar structures in the world, so does the **"Triumph" Press** surpass all other Brick Presses as the Ideal of Perfection, in Simplicity, Durability, Capacity, and Money-earning qualities.

The **cost** of making **pressed bricks** on the **"Triumph"** is **less** than on **any other press** and **less** than by **any other known method** of making bricks, while the **quality** of its product is **unequaled.**

KULAGE MACHINE WORKS,
College Avenue, St. Louis, Mo.

We construct and equip brick plants of any capacity complete. We also manufacture the "Triumph" Gathering and Loading Machine — a money-saver and money-maker for the brickmaker. This machine gathers the previously plowed and dried clay from the field and loads same into carts or wagons. With two or three horses and one driver, its capacity is the gathering and loading of as much clay as twenty men with shovels would do. **The benefits to be derived of one machine are enormous.** Progressive brickmakers will please write us.

KULAGE MACHINE WORKS, COLLEGE AVE., ST. LOUIS, MO.

HERE IS ONE

Representation of a FIREPLACE MANTEL. Our Sketch Book, containing 39 others, will be sent you on application.

JUST THE THING

FIREPLACE MANTELS MADE OF MOULDED BRICK

In such Colors as Red, Cream, Buff, Pink, Brown, and Gray. These Mantels cost no more than other kinds, but are far better. They are easily set, and have a richness and simplicity of effect which is decidedly pleasing.

PHILA. & BOSTON FACE BRICK CO.,
No. 4 LIBERTY SQUARE, BOSTON, MASS.